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INTRODUCTION

Nuclear Science Abstracts (NSA) is issued twice a month by the Atomic Energy Commission (AEC). It is intended primarily to serve scientists and engineers working within the Atomic Energy Project, by abstracting as completely and as promptly as possible the literature of nuclear science and engineering. It covers not only unclassified and declassified research reports of the AEC and its contractors, but also material in its field of interest which appears in unpublished research reports of government agencies, universities, and industrial research establishments, and in the technical and scientific journals.

DECLASSIFICATION

The issuance of these abstracts does not constitute authority for declassification of any reports.

INDEXES

Nuclear Science Abstracts is indexed by personal and corporate author, by subject, and by report number. Annual index issues are prepared for each volume. A cumulated index to Volumes 1-4 was issued as Volume 4, No. 24B, Dec. 30, 1950, covering authors, subjects, nuclides, and report numbers. The 24th number of Volumes 5, 6, and 7 contains indexes covering the individual volumes, as well as a cumulated Numerical Index of Reports covering *Abstracts of Declassified Documents (ADD)*, Vols. 1 and 2, and the previously issued *NSA* volumes. Issues 24A of Vols. 8 and 9 contain author and subject indexes and a Numerical Index of Reports for items abstracted in each volume. A separate publication (TID-4000, Cumulated List of Available Unclassified AEC Reports) contains a Numerical Index of Reports cumulated through Vol. 8 of *NSA*.

Each issue of Vol. 10 (1956) contains an Author Index and a Numerical Index of Reports for abstracts in that issue as well as new availability information on reports abstracted previously. Subject and author indexes, as well as a cumulation of the Numerical Index of Reports, are issued as a supplement to the 12th issue. The 24th issue will be the annual index for the volume.

Nuclear Science Abstracts carries in issues 6B, 12B, 18B, and 24B lists of New Nuclear Data in which experimental results are displayed in tabular form and arranged by element and isotope, with each entry including a reference. The listing in No. 24B is the annual cumulation. The lists of New Nuclear Data are compiled by the Nuclear Data Group of the National Research Council, Washington 25, D. C. The New Nuclear Data items are also supplied by this group on 3×5 in. cards for $20.00 a year domestic and about $30.00 a year foreign (air mail postage included.)

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    Council for Scientific and Industrial Research

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OF USAEC RESEARCH AND DEVELOPMENT LITERATURE

The following publications prepared by the Technical Information Service may be of assistance to librarians and users of AEC report literature. Individuals desiring copies of the publications should note the "availability" information after each item.

TID-4000
Cumulated Numerical List of Available Unclassified U. S. Atomic Energy Commission Reports. February, 1955. ?^4p. Available from Superintendent of Documents, Government Printing Office, Washington 25, D. C. $1.00.

TID-4550 (Rev. 2)
Availability of USAEC Research and Development Reports. September, 1954. 22p. Available gratis from Technical Information Service, Oak Ridge, Tennessee.

TID-5001 (1st Rev.)
Subject Headings Used in the Catalogs of the United States Atomic Energy Commission. First Revised Edition. Donald D. Davis, ed. March, 1955. 368p. Available from Office of Technical Services, Dept. of Commerce, Washington 25, D. C. $2.10.

TID-5059 (2nd Rev.)
Corporate Author Entries Used by the Technical Information Service in Cataloging Reports. (Second Revised Edition). Charlotte F. Chesnut, Alden G. Greene, and Emil Schafer, comps. March, 1955. 234p. Available from Superintendent of Documents, Government Printing Office, Washington 25, D. C. $1.25.

Guide to AEC Reports for the Depository Libraries. USAEC 1954. Available gratis from Technical Information Service, Oak Ridge, Tennessee.

A Business Man Asks; How Can I Keep Up With Atomic Energy Development? USAEC, Washington 25, D. C. Revised September, 1955. Available gratis from Industrial Information Branch, Technical Information Service, Atomic Energy Commission, Washington 25, D. C.

What's Available in the Unclassified Atomic Energy Literature —And Where You Find It. 1955. Available gratis from Industrial Information Branch, Technical Information Service, Atomic Energy Commission, Washington 25, D. C.

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GENERAL

RESEARCH PROGRAMS

1   BNL-355

Brookhaven National Lab., Upton, N. Y.
QUARTERLY PROGRESS REPORT FOR APRIL 1 – JUNE 30, 1955. (Unclassified Section). [Sept. 1955]. 69p.

Abstracts are given for papers prepared for presentation at the International Conferences on the Peaceful Uses of Atomic Energy; at the 1955 Gordon Conference; for research activities being reported concurrently in the scientific journals, with appropriate journal references; and for the interim report of the study group on the Liquid Metal Fuel Reactor. Cosmotron improvements made during the period are briefly discussed. Work on the alternating gradient synchrotron was continued, and the status of development of various components is reported. New meteorological instruments designed during the period which are described briefly include a gustiness analyzer and an airborne filter sampler. The status of work on special radioisotopes development, ultimate waste disposal, and fission product utilization is summarized. Design of a neutron time-of-flight analyzer and of various electronic circuits are described briefly. Miscellaneous health physics activities are summarized. Preliminary results are presented from studies on radiation-induced mutations in plants; the radiosensitivity of mutant production as a function of the stage during oögenesis in Drosophila; the carcinerogenetic effect of combined graded local β irradiation plus graded whole-body γ or x irradiation in rats; the long-term effects of I^{131} in rats, the effect of n-methyl-phenyl-ethyl-barbituric acid on thyroid function in rats; the metabolic pathways of carbohydrate formation in diabetes; the effects of γ radiation on acetylcholinesterase; tracer studies on the excretion of Mn in man; the toxicity of B in mice; ion transport across the human red cell membrane; calibration of a slow neutron beam by biological means; and methods for the intracarotid injection of B. (For preceding period see BNL-337.) (C.H.)

BIOLOGY AND MEDICINE

2   UCLA-346

California. Univ., Los Angeles. Atomic Energy Project.
VELOCITY DISCONTINUITY INSTABILITY OF A LIQUID JET. B. Dunne and B. Cassen. Oct. 4, 1955. 23p. Contract AT-04-1-GEN-12.

A theoretical study and an experimental program using spark shadowgraphic methods has demonstrated that the frequently observed nodules on high speed liquid jets originate from sudden velocity increases in the jet as it issues from the ampule orifice. These nodules have been suspected to be the physical agent responsible for pain sensation in hypodermic jet injection. It has been shown that jets can be produced by suitable means which have no or very little nodule formation associated with them, and thus presumably would produce a lesser incidence of pain in hypodermic jet injections. (auth)

3   UCRL-3145

California. Univ., Berkeley. Radiation Lab.
THE EFFECT OF HEPARIN ON THE CONCENTRATIONS OF TRIGLYCERIDES AND FREE FATTY ACIDS IN LYMPH. Wei Young and Norman K. Freeman. Sept. 22, 1955. 12p. Contract W-7405-eng-48.

4   UR-404

Rochester, N. Y. Univ. Atomic Energy Project.
ION EXCHANGE PROPERTIES OF CELLS AND TISSUES. Aser Rothstein. June 27, 1955. 41p. Contract W-7401-eng-49.

All cells and tissues behave as ion exchange systems. Exchanges are of two types, the first between fixed charges of solid phases and the ions in the solution phase and the second between the ions in two solution phases separated by a membrane. The simplest kinds of ion-exchanges are those of the first type, for example, between cartilage or fibrous structures and body fluids. The reactive groups of the solid phase may be sulfate, a carboxyl or amino groups of the mucopolysaccharides or carboxyl, imidazole or amino groups of proteins. In the cell, ion exchanges occur between the solution phase of the cytoplasm and the solid or gel structures. In addition to the proteins, the nucleic acids and phospholipids may contribute reactive sites. The ion exchanges of the cell as a whole involve exchanges across membranes as well as between solid-solution systems. The ion exchanges of cells involve many complicating factors, the most important of which is the ability of cells to maintain an internal ionic composition considerably different from that of the surrounding medium by means of metabolically controlled ion-transport systems. The cell is not in equilibrium with the environment with respect to ions. It maintains a steady state in which the tendency of ions to reach equilibrium distribution is counteracted by the action of the ion transport systems. The various factors which control ion exchanges in cells include: the permeability of the cell membrane, the activity gradients, the active transport systems and the coupled metabolic reactions, the Donnan effect due to non-diffusible ions, the presence of soluble chelating agents, the presence of solid phase elements with fixed ionic groups, the production or destruction of ions by metabolism, and the compartmentalization of the cell. The ion exchange properties of cells are of primary importance in many physiological functions such as nerve conduction, muscle contraction, as well as many enzyme reactions. (auth)

5   AEC-tr-2273

VEGETATIVE HYBRIDIZATION OF ANIMALS BY CONNECTING THEIR BLOOD STREAMS DURING EMBRYOLOGICAL DEVELOPMENT. Milan Hašek. Translated from Českoslov. Biol. 2, 265-77(1953). 36p.

6   AEC-tr-2274

BIOLOGY AND THERMODYNAMICS OF IRREVERSIBLE PHENOMENA. I. Prigogine and J. M. Wiame. Translated from Experientia 2, 451-3(1946). 9p.

The thermodynamic study of systems in which stationary (non-equilibrium) states were possible, led to a number of general conclusions. These conclusions are summarized and briefly discussed from a biological standpoint. It appears that the evolution of such systems is toward states with the least production of entropy (per mass unit) compatible with the conditions imposed. In the case of living matter this corresponds approximately to states of minimum metabolism. During this evolution the entropy contained in the system may decrease while the heterogeneity increases. But this increase in heterogeneity can only take place when there is a decrease in the entropy production, that is an evolution of the metabolism. We are thus led to suggest a physico-chemical interpretation of Lamarchism. Finally we call attention to the fact that the moderation principle of LaChatelier-Braun is not limited to equilibrium states. (auth)

7   AEC-tr-2276

IMMUNOLOGICAL RELATIONSHIPS BETWEEN EMBRYONIC PARABIONTS OF DUCK AND CHICKEN. Bohdan Frenzl, Milan Hašek, Vera Hašková, and Thomáš Hraba. Translated from Českoslov. Biol. 4, 1-6(1955).

8

ANTIBODY PRODUCTION BY THYMUS AND PEYER'S PATCHES INTRAOCULAR TRANSPLANTS. Richard D. Stoner (Brookhaven National Lab., Upton, N. Y.) and William M. Hale (Univ. of Tennessee, Memphis). J. Immunol. 75, 203-8(1955) Sept.

9

HEMORRHAGIC DISORDER FOLLOWING MASSIVE WHOLE BLOOD TRANSFUSIONS. Julius R. Krevans and Dudley P. Jackson (Johns Hopkins Univ. School of Medicine and Hospital, Baltimore). J. Am. Med. Assoc. 159, 171-7(1955) Sept. 17.

Thirty-two patients who received one or more whole blood transfusions were studied. Twenty-seven were adults who received transfusions for a variety of clinical disorders, and five were newborn infants who received exchange transfusions for hemolytic disease of fetus or newborn infant. Of the adult patients, 14 received more than 5,000 ml of whole blood within a 48 hour period. All 14 developed thrombocytopenia, and 11 developed clinical evidences of abnormal bleeding. Thirteen of the adult patients received less than 5,000 ml of whole blood within a period of 48 hours. Some of these 13 developed mild thrombocytopenia, but none developed evidences of abnormal bleeding. All five of the new-born infants who received exchange transfusions for hemolytic disease developed thrombocytopenia, and two had clinical evidences of abnormal bleeding. Fibrinogenopenia was not the cause of the abnormal bleeding and was encountered in only one instance. The thrombocytopenia that was observed in these patients was related to the amount of whole blood transfused and the rate of infusion. (auth)

AEROSOLS

10   NYO-4644

New York Operations Office. Health and Safety Lab., AEC. STANDARD PROCEDURES FOR ASSESSING AVERAGE DAILY AIR CONTAMINANT EXPOSURES. Paul B. Klevin and William B. Harris. May 2, 1955. 9p.

A procedure is presented for rapidly and efficiently evaluating average occupational exposures to hazardous environmental factors. This procedure has been used for several years and has been proved both effective and accurate. Typical examples of dust exposure evaluation are presented with forms suitable for collecting and recording data. Methods and calculations are discussed. (auth)

RADIATION EFFECTS

11   AECD-3684

Mound Lab., Miamisburg, Ohio.
REPORT FOR BIOLOGICAL RESEARCH [FOR] MARCH 19, 1951 TO JUNE 18, 1951. July 23, 1951. Decl. with deletions Oct. 7, 1955. 66p. Contract AT-33-1-GEN-53.

12   AECD-3685

Mound Lab., Miamisburg, Ohio.
REPORT FOR BIOLOGICAL RESEARCH [FOR] JUNE 18, 1951 TO SEPTEMBER 17, 1951. Oct. 22, 1951. Decl. with deletions Oct. 3, 1955. 73p. Contract AT-33-1-GEN-5[3].

13   AECD-3686

Mound Lab., Miamisburg, Ohio.
REPORT FOR BIOLOGICAL RESEARCH [FOR] SEPTEMBER 17, 1951 TO DECEMBER 17, 1951. Jan. 21, 1952. Decl. with deletions Oct. 3, 1955. 65p. Contract AT-33-1-GEN-53.

14   AECU-3050

Michigan. Univ., Ann Arbor. Engineering Research Inst.
THE DESIGN OF A GAMMA IRRADIATION FACILITY FOR THE CONTROL OF INSECT INFESTATION IN FLOUR, MEAL, OR GRAIN. L. E. Brownell, J. V. Nehemias, and J. J. Bulmer. May 1955. 23p. Contract AT(11-1)-162.

The feasibility of using γ radiation to control insect infestation in stored flour, grains, and cereal products is considered. Results from tests of the effect of γ radiation on the baking quality of wheat flours are included. Using two cooling reactor-fuel elements to provide a radiation dose of 25,000 rep, and based on operation for 260 days per year and plant amortization over a 10-year period, the cost for the irradiation of flour is estimated to be $0.0373 per 100-pound sack. Fuel elements were chosen as a radiation source in lieu of the mixed fission products or separated radioisotopes, because of the availability of such fuel elements. The plant was designed to operate for one 8-hour shift per day. If two or three shifts were used, the cost of irradiation could be decreased. Using three shifts per day, it was estimated that the cost for irradiation could be reduced to less than $0.02 per 100-pound sack. Another method of reducing costs would be to increase the capacity by increasing the radiation flux. Thus, four, six, or eight fuel elements might be used rather than two. The limit to increasing the radiation flux would be determined primarily by the handling capacity of the flour mill. (auth)

15   AECU-3099

Los Alamos Scientific Lab., N. Mex.
QUANTITATIVE BIOLOGICAL METHODS FOR STUDYING RADIATION EFFECTS IN MAMMALS. John B. Storer and Wright H. Langham. [1954?]. 43p. Contract [W-7405-eng-36].

The quantitative mammalian responses described have been utilized by the Biomedical Research Group of the Los

Alamos Scientific Laboratory in determinations of relative biological effectiveness of various prophylactic and therapeutic agents against radiation injuries. Ten different quantitative biological responses of mice and/or rats to ionizing radiations have been used in various studies involving exposures to x and γ radiation, neutrons of various energies, mixtures of γ radiation and neutrons, and parenterally administered β and α emitters. The test systems gave quantitative dose-response curves which can be transformed to straight lines and characterized by mathematical expressions. The mammalian responses described include: median lethal dosage determinations; median survival time; splenic and thymic atrophy; testicular atrophy; intestinal atrophy; whole body weight loss; depression of Fe^{59} uptake by red blood cells; incidence of lens opacities; incidence of heterologous tumor implants in irradiated animals; and duration of depression of mitotic activity. (50 references.) (C.H.)

16   NM-006-012.04.82

Naval Medical Research Inst., Bethesda, Md. and Naval
  Radiological Defense Lab., San Francisco.
SKIN LESIONS, EPILATION AND NAIL PIGMENTATION IN MARSHALLESE AND AMERICANS ACCIDENTALLY CONTAMINATED WITH RADIOACTIVE FALLOUT. Robert A. Conard, Nahum R. Shulman, David A. Wood, Charles L. Dunham, Edward L. Alpen, and L. Eugene Browning. Aug. 29, 1955. 28p.

Following the detonation of a thermonuclear device in the Marshall Islands in the Spring of 1954 a significant amount of radioactive fallout material was deposited on neighboring Pacific islands. Of the 239 Marshallese people and 28 Americans exposed, 64 Marshallese on the island of Rongelap received the highest dose of whole-body penetrating radiation (an estimated 175 r), the most extensive epilation and beta lesions of the skin, and small amounts of internal absorption of radioactive materials. Other island groups were less heavily irradiated. This report is concerned with the epilation and beta lesions which occurred. Many individuals in the higher exposure groups complained of burning and itching of the skin during the first 24 to 48 hr after exposure. Epilation and skin lesions were observed, beginning approximately two to three weeks after exposure, on skin areas contaminated with fallout. Bluish-brown pigmentation of the fingernails was also a common finding. No primary or secondary erythema was observed and consistently the first evidence of skin damage was increased pigmentation in the form of dark brown to black macules, papules, and raised plaques. The lesions developed largely on the exposed parts of the body not protected by clothing, and occurred usually in the following order; scalp (with epilation), neck, axillae, antecubital fossae, feet, limbs, and trunk. Epilation and lesions of the scalp, neck, and foot (dorsal surface) were the most common. The majority of lesions were superficial without vesicle formation, and after simple dry desquamation healed and repigmented. Approximately 20% of the people in the highest exposure group developed deeper lesions, usually occurring on the feet or neck and were characterized by wet desquamation with ulceration, mild burning, itching, and pain accompanied the lesions. The majority healed rapidly with nonspecific therapy. Residual pigment aberration consisting of hyperpigmentation and lack of repigmentation and mild atrophic changes were noted in some deeper healed lesions at six months and one year. Regrowth of hair, normal in color and texture, began about nine weeks post-

exposure and was complete at six months. Biopsies of typical lesions at three to six weeks showed changes consistent with radiation damage with marked epidermal damage and much less severe dermal damage. Biopsies at six months showed only a few residual changes. The nail discoloration had grown out completely at six months in all but a few individuals. (auth)

17   NP-5792

Quartermaster Food and Container Inst., Chicago.
IONIZING RADIATIONS; THEIR PRODUCTION, EFFECTS, AND UTILIZATION (WITH SPECIAL REFERENCE TO FOOD AND PACKAGING TECHNOLOGY). Bibliographic Series No. 4. Supplements No. I and II. Aug. 1955. 536p.

A total of 2939 references are included covering the production, effects, and utilization of ionizing radiations in the sterilization of food. (See also NP-5793.) (C.H.)

18   NP-5793

Quartermaster Food and Container Inst., Chicago.
IONIZING RADIATIONS: THEIR PRODUCTION, EFFECTS, AND UTILIZATION (WITH SPECIAL REFERENCE TO FOOD AND PACKAGING TECHNOLOGY). Bibliographic Series No. 4. Supplements No. I and II. Subject Index. Aug. 1955. 159p.

This is a subject index to NP-5792, which contains 2,939 references covering the production, effects, and utilization of ionizing radiations in the sterilization of food. (C.H.)

19   UR-296

Rochester, N. Y. Univ. Atomic Energy Project.
EXTRA EMBRYONIC VASCULAR DETERIORATION IN THE IRRADIATED CHICK EMBRYO. M. Goldman, S. R. Glasser, and L. W. Tuttle. Aug. 3, 1955. 10p. Contract W-7405-eng-49.

Chick embryos exhibit extensive intraembryonic hemorrhage a few hours after 12 day old fertile eggs are exposed to 800 r of 250 kvp x rays. In fenestrated eggs, successive microscopic examinations are used to assess the course of radiation induced injury to the vessels of the allantoic and vitelline membranes. Vascular degeneration and impaired blood flow are reported on an arbitrary scale of five and supplemented by photomicrographs. Vascular degeneration was pronounced within 2 hr after irradiation and reached a maximum by 20 hr at which time 62% of the embryos were dead. On the five rank scale, the vascular damage in the irradiated eggs scored three to four prior to death compared with similarly handled non-irradiated controls which scored zero to one throughout the experiment. Disintegration of the extraembryonic vascular plexi rather than extraembryonic hemorrhage was the prominent feature of the observations. (auth)

20   UR-403

Rochester, N. Y. Univ. Atomic Energy Project.
THE LETHAL EFFECT OF ACUTE X-IRRADIATION ON RATS AS A FUNCTION OF AGE. J. B. Hursh and G. Casarett. Mar. 31, 1955. 11p. Contract W-7401-eng-49.

An experiment was performed in which groups of 16-month-old female rats of a Wistar strain were given single doses of 0, 350, 450, 550, and 650 r of 250 kvp x radiation. The 30-day lethality of these rats is compared with that of 6-month-old female rats receiving 0, 650, and 750 r as single doses. The LD_{50} of the 16-month-old group is 600 r as contrasted with 715 r for the 6-month-old rats. (auth)

21   USNRDL-TR-56

Naval Radiological Defense Lab., San Francisco.
CONDITIONED RESPONSES TO MANIPULATIVE
PROCEDURES RESULTING FROM EXPOSURE TO GAMMA
RADIATION. J. Garcia, D. J. Kimeldorf, and E. L.
Hunt. Aug. 9, 1955. 17p. Project NM-006-015.

The use of gamma radiation as a conditioning stimulus
is under investigation. It was found that confinement of rats
in plastic radiation chambers without actual exposure to
radiation resulted in decreased food and water consumption
in rats which had previously experienced eating and drink-
ing during irradiation under similar confinement. Animals
which were deprived of both food and water during exposure
did not show the decrement in food and water intake during
subsequent confinement in the radiation chamber. Three to
five 8-hr exposures (75 r each) were employed to produce
these effects. In contrast, control animals which were sub-
jected to a series of confinements without radiation expo-
sure tended to increase their consumption during the later
confinement tests. It is concluded that manipulation and
confinement acted as conditioned stimuli to produce the
reduction in consumption and that ingestion of food and/or
water during exposure was necessary to produce the
effect. (auth)

22   USNRDL-TR-57

Naval Radiological Defense Lab., San Francisco.
TEMPORAL RELATIONSHIPS WITHIN THE CONDITION-
ING OF A SACCHARIN AVERSION THROUGH RADIATION
EXPOSURE. J. Garcia, D. J. Kimeldorf, and R. A.
Koelling. Aug. 10, 1955. 18p. Project NM-006-015.

The optimal temporal relationships in the establishment
of a conditioned aversion in rats to saccharin-flavored
water by the use of gamma radiation is under investigation.
Ingestion of the saccharin solution during exposure to
radiation produced the strongest aversion as measured by
post-irradiation preference tests. Animals which drank
the fluid immediately after irradiation did not display an
aversion towards saccharin flavor in the preference test,
whereas some conditioning was evident in animal receiving
saccharin-flavored water immediately prior to irradiation.
Thus the optimal sequence for establishing the conditioned
aversion is a temporal coincidence or radiation exposure
and saccharin consumption. These relationships are con-
sistent with accepted concepts of temporal relationships
in conditioning and learning. (auth)

23

ACTION OF X RAYS ON CREPIS ZACINTHA L. BABC.:
INFLUENCE OF DIFFERENT FACTORS ON THE RATE OF
CELLULAR LETHALITY PRODUCED BY X RAYS. Andre
Bilquez. Compt. rend. 241, 900-2(1955) Nov.

Some seeds of Crepis Zacintha L. Babc. (chicory),
having different water contents, were subjected to x
radiation. The irradiated material was made to germinate
at variable temperatures. Cytological studies, made at the
first stage of the first division of germination, show that
the sensitivity as regards x rays varys greatly according
to the experimental conditions. (tr-auth)

24

THE EFFECT OF X RAYS ON THE NERVE ELEMENTS
OF THE CORNEA. T. V. Krestinskaya (Pavlov First
Leningrad Med. Inst.) Doklady Akad. Nauk S.S.S.R. 103,
243-6(1955) July 11. (In Russian)

25

ON THE SIGNIFICANCE OF RADIATION INTENSITY ON
ANIMAL ORGANISM DAMAGED BY X RAYS. B. M.
Graevskaya, and R. Ya. Keilina. (Inst. of Biological
Physics.). Doklady Akad. Nauk S.S.S.R. 103, 427-9(1955)
July 21. (In Russian)

26

A STUDY OF THE IRRADIATION SYNDROME. PART II.
TISSUE WATER AND TISSUE ELECTROLYTES. Roy E.
McDonald, Ross E. Jenson, Herbert C. Urry, and Philip B.
Price (Univ. of Utah Coll. of Medicine, Salt Lake City).
Am. J. Roentgenol. Radium Therap. Nuclear Med. 74, 889-
97(1955) Nov.

A study has been made of water and electrolytes in
canine tissues following total-body irradiation, with an
attempt to delineate those changes which are due essentially
to irradiation. (auth)

27

RECIPROCAL ACTION OF RADIATION WITH MATTER.
W. Hanle. Strahlentherapie 98, 4-20(1955) Sept. (In
German)

The importance of considering the reciprocal action of
high-energy radiations with matter in biological and other
technological studies is stressed. Characteristics of the
different types of radiation and the origin of artificial
radiations are reviewed. Factors affecting excitation,
ionization, and chemical effects, and the influence of gases,
liquids, and solids on these effects are discussed. (C.H.)

28

EXCRETION PATTERNS OF RATS FOLLOWING TOTAL-
BODY EXPOSURE TO X-RADIATION. Roy B. Mefferd, Jr.
and Herman H. Martens (Southwest Foundation for Re-
search and Education and Trinity Univ., San Antonio, Tex.).
Science 122, 829-30(1955) Oct. 28.

29

RADIATION STERILIZATION OF FOODSTUFFS. A RE-
PORT TO MANAGEMENT. Nelson J. Dysart, Edwin S.
Gozonsky, James Krogzemis, Ronald K. Jones, Clive
Lawler-Wilson, Robert H. Lundin, Melvin H. Roboff,
Michael Rudge, and Marlow A. Sigal. Boston, Harvard
Business School, May 1954. 112p.

The commercial possibilities of applying radiation to the
sterilization of foodstuffs is discussed from the point of
view of the businessman. Progress in research in the field
is summarized. Advantages and disadvantages of the use of
x radiation, cathode rays, and atomic wastes as radiation
sources are discussed. The effect on manufacturing and
distributing in the food industry are postulated, the magni-
tude of the investment required is considered, and it is
concluded that radiation sterilization is the most significant
development in terms of the future of the food industry,
provided that the harmful side-effects can be eliminated.
(60 references.) (C.H.)

30

γ-IRRADIATION OF PNEUMOCOCCUS DEOXYRIBO-
NUCLEIC ACID. Ruth M. Drew (Brookhaven National Lab.,
Upton, N. Y.). Radiation Research 3, 116-20(1955) Oct.

The effect of γ irradiation on pneumococcus type III
DNA has been studied. The transforming activity of DNA
irradiated in saline solution was destroyed at low radiation
dose levels. A much higher tolerance was observed when
DNA was irradiated in cysteine solution, and transforming
activity could be demonstrated in material which had re-

ceived as much as 250,000 rep. Highly active transforming principle was isolated from cells exposed to 100,000 rep. (auth)

31

DEUTERON CROSS SECTION OF β-AMYLASE IN VITRO AND IN VIVO. John Jagger and Dwight Wilson (Yale Univ., New Haven, Conn.). Radiation Research 3, 127-34(1955) Oct.

Different preparations of malt β-amylase in the dry state have been bombarded with 3.75-Mev deuterons. The amylase was in a relatively pure form, in an immediately extracted form, and within barley seed slices. Although there is a wide spread of cross sections, the range of this spread is the same for all three preparations, and the spread is attributed to a complex population of amylase molecules. It is concluded that β-amylase responds to ionizing radiation in essentially the same manner in all three cases and that, consequently, conclusions reached from radiation studies of semipurified enzymes can be extended to nonmetabolizing living systems in the dry state. (auth)

32

EFFECT OF VARIOUS DOSES OF X-RAYS ON THE NUMBER OF CELLS SYNTHESIZING DEOXYRIBONUCLEIC ACID. S. R. Pelc and Alma Howard (Hammersmith Hosp., London). Radiation Research 3, 135-42(1955) Oct.

The number of cells synthesizing DNA (observed by means of autoradiographs as uptake of P^{32} into DNA in a form not removed by acid hydrolysis) in Vicia faba root meristems is reduced by moderate doses of x rays to about 60% of the normal value during the subsequent 12 hours. Reduction is the same after doses of 50 r to 200 r. This result is interpreted to be due to a greater radiosensitivity to delay or inhibition of DNA synthesis on the part of cells which are in approximately one-third of the cell cycle at the time of irradiation (the first part of interphase) than in cells at other stages of the cycle. It is suggested that many of the results reported in the literature, in which the amount of tracer incorporated into DNA at early times after moderate doses of radiation has been observed biochemically to be roughly one-third to two-thirds that in controls, could be explained on the hypothesis that only a part of the irradiated cell population is primarily affected. (auth)

33

DOMINANT LETHAL MUTATION AND X-CHROMOSOME ELIMINATION AFTER X-IRRADIATION OF FEMALE DROSOPHILA MELANOGASTER. R. C. King (Brookhaven National Lab., Upton, N. Y.). Radiation Research 3, 143-52 (1955) Oct.

A study was made of the frequency of dominant lethals and X-chromosome losses found in eggs laid at successive daily intervals after x ray treatment of female Drosophila. Successive batches of eggs represent cells which were at increasingly early meiotic stages at the time of treatment. No significant difference in fecundity was detected between control and irradiated female flies, which indicates that mutant-bearing oöcytes are not prevented from maturing and being laid as eggs. The induced mutation rate relation in successive batches of eggs was found to be similar for the two types of mutation studied. The rate is fairly constant in the first eggs laid; it then falls abruptly to a lower constant rate and subsequently declines. The reduction in the rate of dominant lethals in successive batches of eggs is far greater than the reduction in the rate of X-chromosome losses in dominant lethal-free eggs or in the rate of sex-linked re-

cessive lethals in X-bearing eggs free of dominant sterility or lethal mutants. These data are interpreted most simply by assuming that x irradiation induces many more chromosome breaks in mature eggs than in oöcytes. However, the primary rates for sex-linked recessive lethal mutation and X-chromosome loss in mature cells are reduced in proportionately greater degree than in immature cells, since relatively more potential mutant cells are never observed because of aneuploidy which results in the death of the zygote prior to maturity. (auth)

34

ON THE DIRECT AND INDIRECT EFFECTS OF X-RAYS ON THE TESTIS OF THE RAT. Henry I. Kohn (Univ. of California School of Medicine, San Francisco). Radiation Research 3, 153-6(1955) Oct.

Changes in weight and histologic appearance of the rat testis were studied after exposure to x rays. The testes were irradiated locally, with the rest of the body shielded, or along with the entire body. The tissue doses were 60, 180, and 210 r. The dose to the testis determined the changes in that organ. The dose received by the rest of the body had little if any effect on the testis. (auth)

35

A COMPARATIVE STUDY OF THE EFFECTS OF β-RAYS, γ-RAYS AND X-RAYS ON DEVELOPMENT IN HABROBRACON. Robert L. Amy (Oak Ridge National Lab., Tenn.; Univ. of Virginia, Charlottesville; and Susquehanna Univ., Selinsgrove, Penna.). Radiation Research 3, 166-81(1955) Oct.

36

THE INCIDENCE OF ENDOGENOUS BACTEREMIA IN X-IRRADIATED RABBITS. Carolyn W. Hammond and C. Phillip Miller (Univ. of Chicago). Radiation Research 3, 191-201(1955) Oct.

37

INFLUENCE OF X-RAY ON OXYGEN CONSUMPTION OF SPLEEN AND THYMUS GLANDS OF RATS. Maurice F. Sullivan and Kenneth P. DuBois (Univ. of Chicago). Radiation Research 3, 202-9(1955) Oct.

The oxygen consumption of slices of spleen and thymus glands from rats given 400 r of whole-body x irradiation was studied manometrically. A marked reduction in the endogenous Q_{O_2} for both tissues was observed. Maximal inhibition was noted at 48 hours after x ray, after which time gradual reversal of the inhibitory effect occurred. The endogenous respiration of the irradiated tissues declined more rapidly than in the case of normal tissues when the incubation period was extended. This indicated more rapid depletion of oxidizable substrates in the slices of irradiated spleens and thymus glands. Addition of glucose, pyruvate, oxalacetate, α-ketoglutarate, glutamate, succinate, fumarate, or malate did not alleviate the radiation-induced inhibition of respiration. (auth)

38

ACTIONS OF RADIATION ON LIVING CELLS. D. E. Lea. Cambridge, England, University Press, 1955. 416p. (Second Edition)

Fundamental actions of x radiation and other ionizing radiations on living cells are reviewed. Mechanisms of actions of radiation on viruses, and on the genes and chromosomes of higher cells are discussed in detail. A mathematical analysis of the data is included. 532 references. (C.H.)

39

BASIC MECHANISMS IN RADIOBIOLOGY. III. BIO-
CHEMICAL ASPECTS. (Cover bears title: BIOCHEMICAL
ASPECTS OF BASIC MECHANISMS IN RADIOBIOLOGY).
Nuclear Science Series Report Number 17. Harvey M.
Patt, ed. Washington, National Academy of Sciences-
National Research Council, 1954. 158p. (Available as
NAS-NRC Publication 367)

The basic mechanisms of biochemical phenomena in
radiobiological actions were discussed. Topics include:
the direct effect of radiation on proteins, viruses, and other
large molecules; the in vitro effects of radiations on
molecules of biological importance; cellular biochemistry;
enzyme and related effects in the intact cell; and changes
in nucleic acid metabolism as a result of radiation. (C.H.)

40

CHANGES IN LENS DURING THE FORMATION OF X-RAY
CATARACT IN RABBITS. Antoinette Pirie, Ruth Van
Heyningen, and P. H. Flanders (Univ. of Oxford, England
and Hammersmith Hosp., London). Biochem. J. (London)
61, 341-7(1955) Oct.

The effect of irradiation on the organic phosphate
compounds in the lens of the very young rabbit has been
studied by the enzymic method of Slater, (Biochem. J.
53, 157(1953)). No change could be detected in the high-
energy phosphate groups of adenosine triphosphate and
adenosine diphosphate, or in hexose monophosphates,
hexose diphosphate, phosphoglycerate or inorganic phos-
phate within a few days of irradiation. A method for the
enzymic determination of creatine phosphate has been
worked out, but the amount in lens is too small for
satisfactory determination. A fall in glutathione was
detected 24 hr after irradiation. The hexose phosphate
and triose phosphate fraction determined enzymically is
considerably less than the same fraction when determined
chemically by the method of Umbreit et al. (1949). This
discrepancy between results given by enzymic and chemi-
cal methods is found in other tissues besides lens.
(auth)

RADIATION HAZARDS AND PROTECTION

41   AMRL-206

Army Medical Research Lab., Fort Knox, Ky.
RESULTS AND INTERPRETATIONS OF X-IRRADIATION
STUDIES WITH ESCHERICHIA COLI. C. R. Goucher,
Ichiro Kamei and W. Kocholaty. Aug. 18, 1955. 17p.
AMRL Project No. 6-59-08-014.

Protection of Escherichia coli B/r from x irradiation by
pre-incubation with metabolizable substrates, such as
succinic acid and ethanol may occur only with dense bac-
terial suspensions, limiting equilibration with the sur-
rounding oxygen, and may be abolished altogether by
shaking the suspension a few seconds before irradiation.
Irradiated suspensions of E. coli B/r showed no dilution
effect: a given irradiation dose resulted in essentially
the same percentage inactivation for suspensions ranging
from 10^4 to 10^9 cells per ml. (auth)

42   ORNL-1860

Oak Ridge National Lab., Tenn.
HEALTH PHYSICS DIVISION SEMIANNUAL PROGRESS
REPORT FOR PERIOD ENDING JANUARY 31, 1955. May
9, 1955. 34p. Contract W-7405-eng-26.

Progress is reported on studies of the metabolism of U

in humans after a single intravenous injection of uranyl
nitrate hexahydrate; the development of a analytical
procedure for the determination of radioactive Sr in urine;
the tissue distribution of Co^{60} in rats; the additive effect of
successive coagulations on the removal of radioactive
materials from water; the exploration of fields for waste
storage pits; the adsorption of fission products by various
types of soil; measurements of aerosol particle size; and
the development of radiation dosimeters. Educational,
training, and consultation activities engaged in during the
period are summarized briefly. (For preceding period
see ORNL-1763.) (C.H.)

43   ORNL-1942

Oak Ridge National Lab., Tenn.
HEALTH PHYSICS DIVISION SEMIANNUAL PROGRESS
REPORT FOR PERIOD ENDING JULY 31, 1955. Oct. 20,
1955. 40p. Contract W-7405-eng-26.

Progress is reported in investigations of possible appli-
cations of the intravenous administration of fissionable U
in man in neutron-capture therapy. Data are tabulated on
the tissue distribution of U in man. Data are summarized
from studies on the uptake of Sr^{89} by earthworms; studies
on containers for the laboratory propagation of arthropods;
the spectrographic analysis of bone ash; the removal of
radioactivity from contaminated water by adsorption of
organic complexes on carbon; the exploration of new fields
and the performance of old fields for waste-storage pits;
evaluation of procedures for the recovery from soil and
identification of the major long-lived fission products; the
cation-exchange capacity and exchange complex of rock
materials from proposed waste-storage sites; the efficien-
cy of sand as an aerosol filter; the half life of fission
products at subsequent times after irradiation for various
periods of reactor irradiation; variations of neutron
damage with energy and geometry; and an aerial survey of
the region between St. Louis, Mo., and Moline, Ill. Educa-
tion, training, and consultation activities engaged in during
the period are reviewed and summaries of papers published
during the period are included. (For preceding period see
ORNL-1860.) (C.H.)

44

PROTECTIVE ACTION OF CARBON MONOXIDE IN
MAMMALIAN WHOLE-BODY X-IRRADIATION. Eugene B.
Konecci, William F. Taylor, and Syrrel S. Wilks (USAF
School of Aviation Medicine, Randolph Field, Texas).
Radiation Research 3, 157-65(1955) Oct.

Whole-body x-irradiated guinea pigs, rats, and rabbits
were tested with carbon monoxide in a variety of treatments.
Carbon monoxide was administered either by inhalation of
0.10% CO or by IP injection of 100% CO. Survival time of
animals treated with CO before and/or after x-irradiation
was significantly longer than irradiated controls. Untreated
guinea pigs given 500 r ($LD_{100(30)}$) died, whereas 50% of the
guinea pigs pre-CO treated and 15% of those post-CO treated
survived the 30-day test period. This difference in per cent
surviving is significant. The increase in survival time due
to pre-CO treatment is not surprising, since it can be
explained as hypoxia. However, at present there is no
explanation for the slight though significant protection
afforded by carbon monoxide when given 0 to 45 minutes
after irradiation. (auth)

45   ————————

REPRESSION AND ENHANCEMENT OF IRRADIATION
EFFECTS ON GRASSHOPPER CELLS BY METABOLIC

POISONS AND OXYGEN. Theodore N. Tahmisian and
Rosemarie L. Devine (Argonne National Lab., Lemont, Ill.).
Radiation Research 3, 182-90(1955) Oct.

RADIOTHERAPY

46

ERGEBNISSE DES VII INTERNATIONALEN KONGRESSES
FUR RADIOLOGIE IN KOPENHAGEN 1953 AUS DEM
GEBIET DER STRAHLENHEILKUNDE (Report of the
Seventh International Congress on Radiology from the
Department of Radiotherapy held in Copenhagen 1953).
E. H. Graul and F. Hess, eds. Muchen/Berlin, Urban and
Schwarzenbert, 1955. 148p. (In German)

The following problems were discussed at the congress on
radiology: recent developments in the field of radiology,
organizational problems of common protective screens, the
problem of chemical protection from radiation, radiation
biological problems, genetic problems resulting from radia-
tion therapy in the region of reproductive glands, research
on the radiation resistance on cancer, a special viewpoint
in cancer therapy, chemotherapy, experience in the treat-
ment of breast cancer, therapy of cervical carcinoma, the
therapy in the laryngeal-pharyngeal region, radiation treat-
ment of skin diseases and other mild conditions, radiation
screens, diagnostic problems in the domain of radiotherapy,
therapy of radioisotopes, medical use of artificial isotopes
in research, diagnosis, and experimental therapy, and
physical problems and methods in radiology—use of radia-
tion, high voltage therapy, production of elections and neu-
trons, scintillation measurements, etc. (J.E.D.)

47

FUNDAMENTAL PRINCIPLES OF X-RAY TREATMENT.
R. du Mesnil de Rochemont. Strahlentherapie 98, 21-9
(1955) Sept. (In German)

Discussions presented during a brief post-graduate
conference on the physical and biological fundamentals of
radiotherapeutical methodology are summarized. (auth)

48

KILOCURIE REVOLVING COBALT-60 UNIT FOR RADIA-
TION THERAPY. L. H. Lanzl, D. D. Davison, and W. J.
Raine (Argonne Cancer Research Hospital, Chicago). Am.
J. Roentgenol. Radium Therap. Nuclear Med. 74, 898-916
(1955) Nov.

A cobalt-60 revolution therapy unit has been designed,
built, and placed in operation. The unit was designed to
hold a source of 1,750 curies, although it could accommodate
a source of twice that strength. The source shield revolves
either completely or in sectors about a recumbent patient.
In addition, the shield itself can be angulated. The distance
from the source to the center of revolution is fixed at 81.6
cm. The treatment cot is aligned by means of one rotational
and three linear motions. Rectangular and square field
shapes of arbitrary size up to 15 by 15 cm are available.
(auth)

TOXICOLOGY STUDIES

49

THE TOLERANCE OF LARGE DOSES OF SODIUM BORATE
INTRAVENOUSLY BY PATIENTS RECEIVING NEUTRON
CAPTURE THERAPY. Herbert B. Locksley and Lee E.
Farr (Brookhaven National Lab., Upton, N. Y.). J.

Pharmacol. Exptl. Therap. 114, 484-9(1955) Aug.

Clinical observations of the effects of intravenously
adminstered borax in doses up to 20 grams (2.12 gm. boron)
are reported. (auth)

TRACER APPLICATIONS

50   AECU-3039

Michigan State Coll., East Lansing.
GROWTH AND ACCUMULATION OF RADIOACTIVITY IN
PLANTS GROWN ON "FISSION FALL OUT" CON-
TAMINATED SOIL. William G. Long, S. H. Wittwer, and
H. B. Tukey. June 9, 1955. 7p. Contract AT(11-1)-159.

51

THE EFFECTS OF SICKLING ON ION TRANSPORT. I.
EFFECT OF SICKLING ON POTASSIUM TRANSPORT.
D. C. Tosteson, E. Carlsen, and E. T. Dunham (Brook-
haven National Lab., Upton, N. Y.). J. Gen. Physiol. 39,
31-53(1955) Sept. 20.

52

THE EFFECTS OF SICKLING ON ION TRANSPORT. II.
THE EFFECT OF SICKLING ON SODIUM AND CESIUM
TRANSPORT. D. C. Tosteson (Brookhaven National Lab.,
Upton, N. Y. and National Heart Inst., Bethesda, Md.).
J. Gen. Physiol. 39, 55-67(1955) Sept. 20.

Refer also to abstract 83.

CHEMISTRY

53   AD-59791

Pennsylvania. Univ., Philadelphia.
[INVESTIGATION OF COLLOIDAL SYSTEMS]. Technical
Report for Year Ending January 31, 1955. Harold
Strange. 41p.

Flocculation data were obtained on ferric oxide and
aluminum oxide sols which were purified by dialysis, using
sodium lauryl sulfate, and Santomerse D (decyl benzene
sodium sulfonate). The pH of several concentrations of
these surfactants with ferric oxide and aluminum oxide
sols were determined. Streaming potential studies were
carried out on purified ferric oxide powder, using a series
of various concentrated solutions of sodium lauryl sulfate
and Santomerse D. Streaming potentials of purified alumi-
num oxide powder were determined using a series of
solutions of potassium chloride, sodium oleate, potassium
laurate, sodium lauryl sulfate, and Santomerse D. Zeta
potentials were calculated from these streaming potentials,
and the results correlated with the results of the floccula-
tion experiments. The critical micelle concentrations of
sodium oleate, potassium laurate, and sodium lauryl sul-
fate were determined by surface tension, conductivity, and
dye absorption methods. The effect of colloidal ferric
oxide on the critical micelle concentration of sodium
lauryl sulfate was studied. (auth)

### 54   AGC-1229-5

Aerojet General Corp., Azusa, Calif.
INORGANIC AND SEMI-ORGANIC POLYMERS. Bi-
monthly Report No. 5 from August 1 through September 30,
1955. C. L. Randolph. Oct. 5, 1955. Contract AF33(616)-
2739.

Preliminary evidence indicates that the high-melting white solid formed by reacting benzeneboronic acid with cyclohexanephosphonic acid is an organoboron phosphonate. A yellow, tacky, water-insoluble material (mol. wt. ~ 1980), melting at 115 to 125°C, has been isolated from the reaction of diphenyldichlorosilane and the disodium salt of cyclohexanephosphonic acid. The reaction of trimethylchlorosilane with disodium cyclohexanephosphonate produced a straw-colored viscous oil which decomposed on heating at 200°C in vacuo (2 mm). The oil is believed to be $(CH_3)_3Si-$

$$O-P-O-Si(CH_3)_3. \quad \text{(auth)}$$

with O and C_6H_{11} substituents.
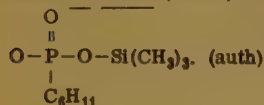
55　　　　BMI-978
Battelle Memorial Inst., Columbus, Ohio.
COMPOSITION OF VAPORS FROM BOILING NITRIC ACID SOLUTIONS. R. C. Crooks, R. Q. Wilson, A. E. Bearse, and R. B. Filbert, Jr. Feb. 9, 1955. 39p. Contract W-7405-eng-92.

The composition of vapors from aqueous HNO_3 solutions boiling at 200 mm mercury total pressure is established for solutions containing between 0 and 67.5 wt. %. The volatility characteristics of low concentrations of chloride in the same concentration range of HNO_3 have been measured in solutions boiling at 200 mm mercury. The effects of Cl^- concentration and pressure of boiling are evaluated. A spectrophotometric method for the determination of Cl^- in nitric acid solutions is described. (auth)

56　　　　CCC-1024-TR-136
Virginia Polytechnic Inst., Blacksburg.
STUDIES OF FLUIDITY IN THE SODIUM-SODIUM HYDRIDE SYSTEM. J. E. Lastovica and N. F. Murphy. Sept. 8, 1955. 13p.

Attempts were made to prepare NaH by the reaction of H_2 with Na and at the same time to maintain a fluid condition in the reactor. Hydrogen was added to Na at various temperatures in a bomb fitted with a solenoid-operated stirrer to determine if the charge had solidified. When the temperature was below that corresponding to the decomposition of NaH at the particular H_2 pressure, the charge in the reactor solidified. Very little NaH, if any, was found dissolved in the Na remaining in the reactor. It was concluded that at the NaH end of the system and at reasonable pressures, there does not seem to be any area of stable fluid composition. (auth)

57　　　　CCC-1024-TR-139
Richmond, Va. Univ.
STUDY OF THE SYSTEM $NaCl-KCl-LiCl-AlCl_3$ IN THE REGION OF MOLE RATION 1:1:1:(3-6). W. E. Trout, Jr. and W. J. Triner, Jr. Oct. 3, 1955. 29p.

Preliminary studies have been made of the phase diagram of the system $NaCl-KCl-LiCl-AlCl_3$ in the region of mole ratios 1:1:1:(3-6), i.e., with variation only in the ratio of $AlCl_3$ to an equimolar mixture of the other three salts. Techniques were developed for loading fusion cells, and cooling curves of mixtures were obtained. In each case the temperature at which solid first appeared was noted. A low-melting region was found to lie between 1:1:1:4.1 and 1:1:1:4.5. The lowest point observed was at 62°C for the mixture 1:1:1:4.24. (auth)

58　　　　CCC-1024-TR-140
Howard Univ., Washington, D. C.
PREPARATION AND PROPERTIES OF BOROHYDRIDES OF THE ALKALINE EARTH METALS. M. D. Taylor, L. R. Grant, C. A. Sands, and M. B. Templeman. Oct. 6, 1955. 13p.

Experiments have been performed for the preparation of Ca, Ba, and La borohydrides. The first two compounds appear to have been obtained as solvates in a reasonably pure state but only in rather small yields. The reactions were generally performed with lithium or sodium borohydride and the appropriate metal iodide in some non-aqueous solvent. Pyridine and tetrahydrofuran were the solvents most commonly used. Two new general methods for preparing anhydrous alkaline earth iodides have been developed and specifically applied in the cases of LiI and BaI_2. Essentially quantitative yields of pure products are obtained by the reaction of the alkaline earth hydride and either I_2 or NH_4I in a non-aqueous solvent. (auth)

59　　　　CCC-1024-TR-141
West Virginia. Univ., Morgantown.
THE EXPLOSIVE REACTION OF DIBORANE IN DRY AND WATER-SATURATED AIR. H. P. Simons and E. L. Poling. Oct. 10, 1955. 128p.

The explosive oxidation of diborane in air was studied by measuring the rate of flame propagation in a tube, the pressure-time characteristics of the reaction in a closed vessel, and the effect of water vapor in the air on each of these characteristics. Product gases from the closed vessel reaction were analyzed and the results correlated with possible paths. (auth)

60　　　　CCC-1024-TR-143
Callery Chemical Co., Penna.
SOME PHYSICAL PROPERTIES OF METHYL BORATE AND METHYL BORATE-METHANOL AZEOTROPE. C. F. Boynton, J. F. Masi, P. E. Gallagher, and R. Kosahovich. Oct. 17, 1955. 15p.

Miscellaneous physical properties of methyl borate and of two component systems containing methyl borate are reported. Included are density and viscosity of methyl borate and of methyl borate-methanol azeotrope, boiling point-composition diagram for the system methyl borate-diethylene glycol dimethyl ether, and refractive index of methyl borate-mineral oil mixtures. (auth)

61　　　　HW-30643(Rev.)
Hanford Atomic Products Operation, Richland, Wash.
THE DETERMINATION OF DIBUTYLPHOSPHATE. D. W. Brite. Oct. 15, 1954. Decl. Mar. 9, 1955. 18p. Contract W-31-109-Eng-52.

A method is described for determining dibutylphosphate concentrations in aqueous or organic solutions with an estimated precision of ±7% (95% confidence limits). As little as 0.5 mg/l dibutylphosphate in aqueous solution and 5 mg/l in 15% tributylphosphate-diluent solutions may be detected. Monobutylphosphate and phosphoric acid do not interfere in concentrations occurring naturally as the hydrolytic products of tributylphosphate. A single determination including a calibration curve, may be made in one hour. Subsequent determinations require only 10 to 15 minutes. (auth)

62　　　　ISC-505
Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN

CHEMISTRY FOR APRIL, MAY, AND JUNE 1954. Aug. 17, 1954. Decl. Oct. 4, 1955. 25p. Contract W-7405-eng-82.

ErI$_3$ can be prepared in 80% yields by heating a mixture of Er$_2$O$_3$ and NH$_4$I under reduced pressure. The vapor pressure of Pd, when measured by the effusion technique is higher than the literature value by a factor of 15. The "double H" type of cell was studied as a possible instrument for determining transport numbers of fused salts, and the transport number of pure PbCl$_2$ was determined. The solubilities of Al in AlI$_3$, Sn in SnCl$_2$, and Pb in PbCl$_2$ were determined. The reaction between Th and water vapor follows a logarithmic rate law, but two types of reaction occur. Analytical procedures are given for V in Al−V alloys, small concentrations of sulfate, Al in presence of small amounts of U, and In in In−Pb alloys. The trifluorides of Nd, Gd, Er, and Yb are completely pyrohydrolyzed at 1000°C in less than 2 hr. The solvent extraction and determination of Li with dipivaloylmethane was studied. The rare earth content of commercial Zr was determined. Studies of the removal of Pu and fission products by liquid metal extraction have continued. In a 70-Mev bremsstrahlung irradiation of As it appears probable that the reaction As(γ,3p3n)Zn[69] occurred. The γ reactions of Fe were studied. Additional experiments on the Szilard-Chalmers process in Os compounds were performed. The ratio of the cross sections of the metastable to ground state of Os[191] was measured as approximately 1 with a scintillation spectrometer. Experiments on the exchange of Cl between Cl$^-$ and Pt chloro-complexes were continued. Measureable quantities of AgIO$_3$ and Ag(IO$_3$)$_2^-$ were found in iodate solutions. (For preceding period see ISC-484.) (J.S.R.)

63   NBS-3329
National Bureau of Standards, Washington, D. C.
EQUILIBRIUM PROPERTIES OF ISOTOPE EXCHANGE REACTIONS OF WATER AND HYDROGEN. Joe C. Bradley. Oct. 15, 1955. 8p. NBS Project 0302-10-2641.

Tables are given from which various equilibrium properties involving isotopic exchange reactions for molecular H and isotopic water molecules can be calculated. (auth)

64   NP-5780
Goodrich (B. F.) Co. Research Center, Brecksville, Ohio.
DEVELOPMENT OF INORGANIC POLYMER SYSTEMS. Bimonthly Progress Report No. 5 for the Period August 1, 1955−September 31, 1955. C. F. Gibbs, H. Tucker, G. Shkapenko, and J. C. Park. 21p. Project No. 5(7-7340). Contract AF33(616)-2744.

Four new chelate compounds of increased thermal stability prepared include mono (1, 3-diphenyl-1, 3-propanediono) aluminum dichloride, mono (1, 3-diphenyl-1, 3-propanediono) aluminum diisopropoxide, dichloro aluminum-8-hydroxyquinolinate, and diisopropoxy aluminum-8-hydroxyquinolinate. They all melt between 320 to 400°C without decomposition. Two materials obtained in attempts to prepare tris(triphenylsiloxy) aluminum are bis(triphenyl siloxy) aluminum chloride and bis(triphenylsiloxy) aluminum isopropoxide. The described reactions between aluminum and silicon compounds indicate that the copolymerization reactions are feasible. (For preceding period see NP-5735.) (auth)

65   RMO-2021
International Minerals and Chemical Corp.
URANIUM PRODUCTION — PROCESS DESIGNS FOR LEACHED ZONE PLANTS. VOLUME X. AMMONIUM BISULFATE DIGESTION OF LEACHED ZONE. D. F. Clements and R. F. McCullough. July, 1953. Decl. Apr. 13, 1955. 46p. Contract AT(49-1)-545. (IMCC-2041)

Process design and cost estimates for the digestion, leaching and filtration steps of plants which produce 450, 225, and 100 tons of uranium per year are presented. Unit operations for the reaction of leached zone with ammonium bisulfate are as follows: reaction of -200 mesh and +14 mesh leached zone with ammonium bisulfate at 300°C and atmospheric pressure; cooling of the reaction products, addition of water, and separation of ammonium alum from the slurry by classification; removal of insoluble reaction products by counter-current filtration. Considerable difficulty was encountered in the laboratory on the classification and filtration steps. Tests indicated that separation of the alum, insoluble leached zone and liquor by classification and filtration would be questionable on a plant scale. (auth)

66   WIN-6
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
CARBONATE LEACHING, ACID LEACHING, SETTLING, AND ION EXCHANGE TESTING OF CAL-URANIUM ORE. D. R. George, J. B. Larson, E. S. Porter, and H. I. Viklund. Oct. 3, 1955. 37p. AT(49-6)-924.

The results of acid and carbonate leaching tests, ion exchange tests of acid leach solutions, thickening tests of acid leached pulps, cyclic carbonate leaching tests, and filtration tests of carbonate leached pulps are described. (auth)

67   WIN-23
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
RESIN-IN-PULP PILOT PLANT TESTING OF LOS OCHOS ORE. C. K. McArthur, A. W. Griffith, and R. W. Shimmin. Oct. 15, 1955. 30p. Contract AT(49-6)-924.

Los Ochos ore from the Gunnison area of Colorado was treated in the Acid Leach Resin-In-Pulp Pilot Plant at Grand Junction, Colorado. This report presents detailed information on leaching, ion exchange, and precipitation in connection with the processing of this ore. Results showed that the ore is very amenable to the process and that relatively low acid consumption was required for good uranium extraction. (auth)

68
A PHYSICO-CHEMICAL STUDY ON THE HYDROLYSIS OF THORIUM NITRATE. Kuan Pan and Tong Ming Hseu (National Taiwan Univ.). Bull. Chem. Soc. Japan 28, 162-4 (1955) Apr.

The hydrolysis of Th(NO$_3$)$_4$ in a very dilute solution and in the presence of NaClO$_4$ has been followed by means of the pH measurement with a glass electrode. Equilibrium constants were calculated for the ion species, Th(OH)$^{3+}$ and Th(OH)$_2^{2+}$. (C.W.H.)

69
THE VAPOR PRESSURE OF RHENIUM. E. M. Sherwood, D. M. Rosenbaum, J. M. Blocher, Jr., and L. E. Campbell (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 102, 650-4(1955) Nov.

The vapor pressure of Re was determined over a temperature range of 2220° to 2725°C. At 2500°C, the vapor pressure of Re is approximately one and one-half times that of Ta. Estimates were made of the boiling point of Re (5630°C) and of the vapor pressure of liquid Re. The computed ΔH°_s of sublimation of Re is 187 kcal. (auth)

70

SOME PHYSICAL CHEMICAL STUDIES WITH HETEROPOLY ACIDS. Melvin C. Baker, Philip A. Lyons, and S. J. Singer (Yale Univ., New Haven, Conn.). J. Phys. Chem. 59, 1074-6(1955) Oct.

The Svedberg equation for velocity ultracentrifugation has been tested with sedimentation, diffusion, and density measurements of solutions of some heteropoly acids. The assignment of the formula $PW_{12}O_{42}^{-7}$ to the phosphotungstate ion at pH 4.5 can be justified, and the molecular weight calculated by the Svedberg equation is in good agreement with the formula weight. For phosphomolybdic acid at pH 4.5, however, the state of the solute is not certain. The calculated molecular weight is consistent with the formula $PMo_{11}O_{39}^{-7}$ for the major solute species. (auth)

71

REVISION OF THE ELECTRODE-POTENTIAL DIAGRAM FOR TECHNETIUM. G. H. Cartledge and William T. Smith, Jr. (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 59, 1111-12(1955) Oct.

The revised potential diagram for Tc is
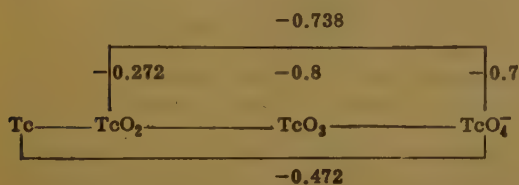
(auth)

72

THE HYDROLYSIS OF TIN(IV) IN SULFURIC ACID. C. H. Brubaker, Jr. (Michigan State Coll., East Lansing). J. Am. Chem. Soc. 77, 5265-8(1955) Oct. 20.

The hydrolysis of Sn^{4+} in dilute H_2SO_4 solutions was studied by the technique of diluting stable acid solutions until solid, hydrous stannic oxide formed in equilibrium with the solution. When reasonable estimates of activity coefficients are taken into account the data demand that the species present in the solutions be sulfato tin(IV) sulfate, $(SnSO_4)$ (SO_4), in contrast to the Sn^{4+} ion which is indicated on the basis of concentration equilibrium considerations. The data indicate that the following takes place: $SnO_2(aq.) + 2H_2SO_4 \overset{K}{=} (SnSO_4)^{++} + (SO_4)^{=} + 2H_2O$. Taking into account the best estimates of the mean activity coefficients which are available, we find, at 30°, $K = 5 \times 10^{-2}$ and, at 18°, $K = 2.8 \times 10^{-2}$. (auth)

73

EXCHANGE OF RADIOCYANIDE ION WITH TUNGSTEN OCTACYANIDE COMPLEXES. Elden L. Goodenow and Clifford S. Garner (Univ. of California, Los Angeles). J. Am. Chem. Soc. 77, 5268-71(1955) Oct. 20.

Essentially no exchange of radiocyanide with $W(CN)_8^{3-}$ and $W(CN)_8^{4-}$ ions in aqueous solution of natural pH occurs in the dark at 25° even after 100 days. At 25° the corre-

sponding respective unimolecular specific rates are $k_1 < 5.9 \times 10^{-8}$ and $k_1 < 5.3 \times 10^{-8}$ sec^{-1}, and the respective bimolecular specific rates are $k_2 < 3.5 \times 10^{-7}$ and $k_2 < 3.1 \times 10^{-7}$ liter mole^{-1} sec.$^{-1}$. The rate law is not known. These exchanges are strongly light-accelerated and the rates under the illumination conditions used are approximately independent of the concentration of free cyanide ion or complex ion. These slow exchanges are consistent with Taube's postulate regarding "inert inner orbital" complexes. The effect of light on the pH of aqueous solutions of these two complex ions was investigated. (auth)

74

THE EXCHANGE REACTION BETWEEN OCTACYANOTUNGSTATE(IV) AND OCTACYANOTUNGSTATE(V) IONS. Elden L. Goodenow and Clifford S. Garner (Univ. of California, Los Angeles). J. Am. Chem. Soc. 77, 5272-4(1955) Oct. 20.

Exchange of radiotungsten between $W(CN)_8^{4-}$ and $W(CN)_8^{3-}$ ions in aqueous solution at complex ion concentrations of 0.001 and 0.0001f and at pH 2.4 to 3.0, 5.8 to 6.6, and 11.3 to 11.8 has been found to be apparently complete in an exchange time of 0.2 sec at 1 to 2° in the dark. The possibility of an induced exchange was not excluded. Heterogeneous exchange between $W(CN)_8^{4-}$ in the aqueous phase and $[(C_6H_5)_4As]_3W(CN)_8$ in the solid phase is approximately one-third complete under the same conditions and with a reaction time of one minute. If it be assumed that the homogeneous exchange is not separation-induced and that the rate law is first order in each of the reactant tungsten complexes, the specific rate at 1 to 2° is greater than 4×10^4 liter mole^{-1} sec.$^{-1}$. Solubility product constants for $[(C_6H_5)_4As]_3W(CN)_8$ and $[(C_6H_5)_4As]_4W(CN)_8$ at 0° were found to be $\sim10^{-15}$ and $\sim10^{-6}$, respectively. The absorption spectra of $K_3W(CN)_8$ and $K_4W(CN)_8$ in aqueous solution are presented. (auth)

75

ON THE MECHANISM OF FORMING SOLID SOLUTIONS IN THE SYSTEM ZrO_2-CaD. E. K. Keller and N. A. Godina. (Silicate Chem. Inst.) Doklady Akad. Nauk S.S.S.R. 103, 247-50(1955) July 11. (In Russian)

76

DISTRIBUTION OF LEAD ISOTOPES BETWEEN THE SOLUTION AND CRYSTALS OF POTASSIUM CHROMATE. M. S. Merkulova and T. S. Shevelkina. (Lomonosov Moscow National Univ.). Doklady Akad. Nauk S.S.S.R. 103, 457-9 (1955) July 21. (In Russian)

77

CONTROLLING MECHANISM IN THE AQUEOUS ABSORPTION OF NITROGEN OXIDES. M. S. Peters, C. P. Ross, and J. E. Klein (Univ. of Illinois, Urbana). A.I.Ch.E. Journal 1, 105-11(1955) Mar.

The reactions involved in the removal of nitrogen oxides from gases by reaction with water are reversible and proceed at a finite rate. It is possible therefore that the overall process is controlled by the rate of the chemical reactions. On this basis an analysis of the process has been developed by the application of chemical kinetics, with consideration of reactions involving both nitrogen dioxide and dinitrogen tetroxide. The resulting differential equation has been simplified and integrated to give a final equation which can be tested experimentally. Theoretical methods are presented for predicting the extent of absorption of nitrogen oxides at various gas rates and concentrations and are

compared with the experimental results. The paper presents some new concepts of the factors which control the rate of absorption of nitrogen dioxide and dinitrogen tetroxide in water. An understanding of the controlling factors in the process should indicate methods for improving the design of absorption towers in nitric acid plants and aid in the design of scrubbers for removing nitrogen oxides from waste gases. (auth)

78

PERFORATED-PLATE EXTRACTION-COLUMN PERFORMANCE AND WETTING CHARACTERISTICS. F. H. Garner, S. R. M. Ellis, and J. W. Hill (Univ. of Edgbaston, Birmingham, England). A.I.Ch.E. Journal 1, 185-92(1955) June.

The type of surface of the perforated plate influences the performance of a perforated-plate column. Pilot plant data on a 4-in column for the system toluene-diethylamine-water at 20°C. show that when the water phase is dispersed and the direction of mass transfer is from the continuous toluene to the dispersed water phase polyethylene plates give a continuous stream of droplets and a higher efficiency, but that when the direction of mass transfer is from the dispersed water to the continuous toluene phase the metal plates give the higher efficiency. (auth)

AEROSOLS

Refer also to abstract 10.

ANALYTICAL PROCEDURES

79   ISC-539
Ames Lab., Ames, Iowa.
HIGH PRECISION MICRO SPECTROPHOTOMETRIC ANALYSIS WITH APPLICATION TO VANADIUM—ALUMINUM ALLOYS. Max Q. Freeland and James S. Fritz. Nov. 9, 1954. 19p. Contract W-7405-eng-82.

An analytical procedure is described for the micro spectrophotometric determination of V in Al—V alloys, based on the reaction (H_2O_2 with V^{5+}). Modifications of spectrophotometric techniques involving the use of unmatched curvettes and the substitution of a standard high absorbance blank for a distilled H_2O blank are discussed. (C.W.H.)

80   ISC-540
Ames Lab., Ames, Iowa.
RAPID MICROTITRATION OF SULFATE. James S. Fritz and Stanley S. Yamamura. Nov. 12, 1954. 14p. Contract W-7405-eng-82.

Small concentrations of sulfate can be determined by a direct titration with 0.005$\underline{M}$ barium perchlorate using Thorin (1-(o-arsenophenylazo)3,6-disulfonic acid) as the indicator. The titration is carried out in 80% alcohol, in the apparent pH range 2.5 to 4.0. The end point is sharp and equilibrium is rapidly attained so that the titration can be rapidly carried out. The method is more versatile when cations are removed by passage of the sample through an ion exchange column prior to the titration. Phosphate makes the method inaccurate but can be removed by a rapid precipitation with magnesium carbonate. The method has been applied to the determination of sulfate in raw

water, treated city water and boiler water. Concentrations of sulfate as low as 10 ppm can be determined accurate to ± 1 ppm. Higher concentrations can be determined with an error of 1% or less. In the absence of phosphate the time required for a complete single determination is only 3 to 5 min. (auth)

81   NBL-117
New Brunswick Lab., AEC, N. J.
QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING JUNE 30, 1955; UNCLASSIFIED SECTION. C. J. Rodden. Sept. 1955. 39p.

Modifications in the present procedure for the continuous polarographic determination of U in process streams are suggested to minimize the interference from V and Mo. Procedures for the preparation of various samples for the determination of Pa were developed. A method for the separation of Th^{230} from U prior to its determination by α counting has been devised. A colorimetric method for the determination of trace amounts of U in metals and ores was developed. Neutron activation techniques have been used for the detection and analysis of Eu, La, Dy, and Sm in rare earth mixtures. The oxine method was used for the determination of trace amounts of V in uranium. A modified Hollander and Rieman method for the macro determination of B in metallic boron has been developed. (C.W.H.)

82   ORNL-1950
Oak Ridge National Lab., Tenn.
THE COMPLEXIMETRIC TITRATION OF ZIRCONIUM BASED ON THE USE OF FERRIC IRON AS THE TITRANT AND DISODIUM-1,2-DIHYDROXYBENZENE-3,5-DISULFONATE AS THE INDICATOR. D. L. Manning, A. S. Meyer, Jr., and J. C. White. Aug. 12, 1955. 15p. Contract W-7405-eng-26.

Zirconium is converted to a stable complex by the addition of an excess of disodium dihydrogen ethylene diamine tetraacetate (EDTA) to a dilute sulfuric acid solution containing zirconium. The excess EDTA is titrated with iron(III) to a disodium-1,2-dihydroxybenzene-3,5-disulfonate (Tiron) end point at a pH of 4.8. Fluoride ion interferes; by complexing the fluoride with beryllium, however, the titration can be conducted in the presence of as much as 4 g of fluoride. Such anions as sulfate, tartrate and phosphate do not interfere. Cationic interferences are relatively few since most metals form weaker complexes with EDTA than do either zirconium or iron. By slight modifications in the procedure, the method is applicable to the determination of zirconium in the presence of moderate amounts of trivalent iron, divalent nickel and trivalent chromium. The method is rapid and simple. The coefficient of variation is less than 1%. (auth)

83   ORO-136
Tennessee. Univ., Knoxville.
PAPER ELECTROPHORETIC STUDIES OF RADIOACTIVE CHROMIUM SALTS IN BLOOD. D. B. Zilversmit, W. J. Visek, and C. L. Comar. Mar. 1955. 7p. Contract AT(40-1)-GEN-242.

Paper electrophoretic studies of chromium salts mixed with rat serum showed that chromic chloride is not present in the ionic form but is primarily bound to plasma proteins; chromic chloride in acetate buffer remains as a negatively charged complex; sodium chromite lacks electrophoretic mobility, a condition consistent with its presence in

colloidal form; and sodium chromate in serum exists largely as the free ion but in the red blood cell it is bound to the hemoglobin. (auth)

84   Y-1096

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn. A CONTINUOUS WATER MONITOR FOR DETECTING PPM QUANTITIES OF ALKALI METALS. J. F. Been. June 20, 1955. 12p. Contract W-7405-eng-26.

A flame photometric system is described which continuously monitors a process water stream for ppm quantities of alkali metals, and automatically diverts the stream when the contamination exceeds a pre-determined level. The minimum operating level is 0.25 ppm of sodium, lithium, or potassium. (auth)

85

SEPARATIONS WITH A MERCURY ELECTRODE. DETERMINATION OF CERTAIN METALLIC IMPURITIES IN VANADIUM SALTS. William E. Schmidt and Clark E. Bricker (Princeton Univ., N. J.). J. Electrochem. Soc. 102, 623-30(1955) Nov.

By means of electrolysis with a mercury cathode, microgram quantities of Cu, Pb, Cd, Zn, Fe, Co, and Ni can be separated from at least 0.5$\underline{M}$ vanadium solutions. Quantitative recovery of all these traces of metals except Cd from the Hg by distillation is satisfactory, and their subsequent estimation by either polarographic or spectrophotometric methods is adequate. Electrolytic stripping of dilute amalgams at controlled potentials shows that the electrodeposited metals could not only be separated into the two major groups of passive (Fe, Co, and Ni) and nonpassive (Cu, Pb, Cd, and Cu) metals, but that separations within the nonpassive group are also possible. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

86   AEC-tr-2287

CRYSTAL FORM AND SPACE LATTICE OF ZIRCONIUM AND HAFNIUM FLUORIDES. G. E. R. Schulze. Translated by K. S. Bevis from Z. Krist. 89, 477-80(1934). 4p.

Zirconium fluoride (ZrF_4) and HfF_4 exhibit the same monoclinic prismatic symmetry (C_{2h}) with a centered unit cell which contains 12 molecules. The space group is C_{2h}^6 and the lattice constants and densities are given. (auth)

87

THE CRYSTAL GROWTH OF LEAD CHLORIDE FROM AQUEOUS SOLUTIONS. S. Z. Lewin (New York Univ., N. Y.). J. Phys. Chem. 59, 1030-4(1955) Oct.

The size, habit, and transparency of lead chloride crystals obtained from aqueous solutions of NaCl, HCl, and $HClO_4$ are correlated with the solubilities of $PbCl_2$ in these media, the time for crystallization to set in, and the rate of cooling and agitation during crystallization. The time for crystals to form and the particle weight are found to parallel the solubility, except for a pronounced inhibition of crystallization in concentrated chloride solutions. The unique effect of hydronium ions in promoting crystal growth, previously found for $SrSO_4$, is shown to be present. (auth)

88

THE CRYSTAL STRUCTURE OF β-PuSi$_2$. O. J. C.

Runnalls and R. R. Boucher (Atomic Energy of Canada Ltd., Chalk River, Ont.). Acta Cryst. 8, 592(1955) Sept.

DEUTERIUM AND DEUTERIUM COMPOUNDS

89

RADIATION-INDUCED EXCHANGE OF HYDROGEN ISOTOPES: CHAIN INHIBITION. Leon M. Dorfman and F. J. Shipko (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Phys. Chem. 59, 1110-11(1955) Oct.

Studies were continued on the radiation-induced exchange reaction between H_2 and D_2. Yields of 2×10^{-4} molecules/ 100 ev at 276 mm total pressure have been obtained. It is believed that the main factor in determining the observed yield is the level of trace impurity since chain inhibition occurs without the deliberate addition of inhibitors. (C.W.H.)

FLUORINE AND FLUORINE COMPOUNDS

90

THE CRYSTAL STRUCTURE OF HEXAFLUOROPHOSPHORIC ACID. Hans Bode and Günther Teufer (Chemisches Staatsinstitut, Hamburg, Netherlands). Acta Cryst. 8, 611-14(1955) Oct. (In Dutch)

The acid $HPF_6 \cdot 6H_2O$ is cubic (space group O^9-Im3m; a = 7.678 A; Z = 2). The water molecules form cubooctahedral cages of 24 oxygen atoms, in the centers of which the phosphorus atoms of the PF_6 groups are situated. This cage-like or clathrate structure is different from that in the gas hydrates. (auth)

91

THE ELECTRIC MOMENTS OF SOME INTERHALOGEN COMPOUNDS. Max T. Rogers, Richard D. Pruett, and John L. Speirs (Michigan State Coll., East Lansing). J. Am. Chem. Soc. 77, 5280-2(1955) Oct. 20.

The electric moments of BrF_3, ClF_3, and IF_5 have been measured in the vapor phase by the refractivity method. A planar T-configuration for BrF_3, similar to that now established for ClF_3, accounts satisfactorily for the dipole moment of the molecule. The large electric moment of IF_5 excludes the trigonal bypyramidal and pentagonal planar structures. It is in satisfactory agreement with a distorted octahedral arrangement in which the iodine atom is probably below the plane of the four fluorine atoms on the side opposite the fifth fluorine atom, and the unshared pair is in the sixth position. (auth)

92

THE MAGNETIC SUSCEPTIBILITIES OF CHLORINE TRIFLUORIDE, BROMINE TRIFLUORIDE, BROMINE PENTAFLUORIDE AND IODINE PENTAFLUORIDE. Max T. Rogers, Morton B. Panish and John L. Speirs (Michigan State Coll., East Lansing). J. Am. Chem. Soc. 77, 5292-3 (1955) Oct. 20.

The magnetic susceptibilities of ClF_3, BrF_3, BrF_5, and IF_5 have been measured in the liquid phase at room temperature using the Gouy method. (C.W.H.)

MOLECULAR STRUCTURE

Refer also to abstracts 91 and 92.

RADIATION CHEMISTRY

93

CHEMICAL STATE OF NITROGEN-13 FORMED BY THE (n,2n) REACTION IN SOLID NITROGEN COMPOUNDS. R. D. Smith and A. H. W. Aten, Jr. (Instituut voor Kernphysisch Onderzoek, Amsterdam, Netherlands). J. Inorg. and Nuclear Chem. 1, 296-300(1955) Oct.

The chemical states of N^{13} after the fast-neutron irradiation of several salts containing nitrogen have been investigated. (C.W.H.)

94

THE REDUCTION OF Ce(IV) IN SOLUTIONS IRRADIATED BY Au^{198} BETA-PARTICLES. B. J. Masters and G. E. Challenger (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 59, 1093-6(1955) Oct.

An automatically recording potentiometric technique has been applied to the study of Ce^{4+} reduction and Fe^{2+} oxidation by Au^{198} β radiation. The observed cerous yield was in general agreement with the values obtained by other investigators using Co^{60} as a radiation source. No significant change in cerous yield was observed during minor variations in irradiation intensity or in the concentrations of Ce^{4+}, Ce^{3+}, and H_2SO_4. The yield was uninfluenced by the presence or absence of dissolved oxygen gas, and a slight positive temperature coefficient was noted. In contrast to the Co^{60} results, dissolved hydrogen gas was found to cause only a small increase in cerous yield. The inhibition of the Ce^{4+} reduction process by Ag^+ also was studied, and a rate expression for this effect was derived. (auth)

95

SHIELDED BOX FOR CHEMICAL WORK. Jan Rydberg (Research Inst. of National Defense, Sundbyberg, Sweden). Nucleonics 13, No. 10, 65(1955) Oct.

Complete descriptions are given of a shielded box permitting work at the curie level. Economic aspects and design advantages are discussed briefly. (B.J.H.)

96

SPACE-SAVING HOT CELL. M. C. Atkins and W. N. Lorentz (Wright Air Development Center, Wright-Patterson Air Force Base, Ohio). Nucleonics 13, No. 10, 79-80(1955) Oct.

Design and description are given for a general purpose hot cell. A primary consideration in the design was the saving of space. (B.J.H.)

97

THE PRODUCTION OF H_2O_2 IN AERATED WATER BY FAST NEUTRONS. M. Ebert, P. Howard-Flanders and R. J. Shalek (Hammersmith Hospital, London). Radiation Research 3, 105-15(1955) Oct.

RADIATION EFFECTS

98

ON THE PRIMARY CHEMICAL MECHANISM FOR THE RADIOLYSIS OF WATER. M. Cottin and M. Lefort (Institut du Radium, Paris). J. chim. phys. 52, 545-55 (1955) July-Aug. (In French)

After having reviewed the principal theories relative to the neutralization of positive ions and electrons and to the combination processes of free radicals formed, information obtained by a measurement of the yields of H and oxygenated water is considered. Reports are given of new experimental results obtained by studying these yields for various solutions irradiated in the absence of air by α and γ rays, particular attention being given to those of KBr and acrylonitrile. For Po α rays, the H yield is constant and thus considered to be independent of the nature of the solute. That of oxygenated water is variable and always less than that of hydrogen. For x and γ rays, the yield of molecular products seems to depend on the dissolved bodies. These results are considered for various hypotheses on the neutralization of ions. (tr-auth)

99

MOLECULAR AND RADICAL YIELDS OF AQUEOUS ACRYLAMIDE SOLUTIONS IRRADIATED WITH X RADIATION OF 50 AND 220 KV. E. Collinson, F. S. Dainton, and G. S. McNaughton (The Univ., Leeds, England). J. chim. phys. 52, 556-69(1955) July-Aug. (In French)

In a neutral, degassed aqueous solution, acrylamide is polymerized by x rays forming a soluble polymer of high molecular weight. The velocity R_p is given by the equation $R_P = (G_1 I/k_t)^{1/2} K_p [m_1]$ moles liter^{-1} sec^{-1}. The degree of polymerization, $\overline{DP}$, is proportional to (m_1) and to Γ^{-a} where a < 0.5. I is the intensity of the radiation in units of 100 ev/l/sec. G_1 is the starting yield equal to the number of chains initiated by 100 ev. k_p/k_t equals 5.2 liter$^{1/2}$ mole$^{-1/2}$ sec$^{-1/2}$. $E_p - E_{t/2} = \sim 2$ kcal. The transfer of the monomer is not produced. The formation of molecular oxygenated water which takes place at the same time as the polymerization, has no influence on R_p or on $\overline{DP}$, but when the acrylamide concentration is increased, the value of $G_{H_2O_2}$ goes through a value close to zero to a maximum of 0.8 ± 0.5 for a monomer concentration between 10^{-3} and 10^{-2}M and falls quickly to about 0.25 for a concentration of 0.5M. This result, as well as the curves which depend on the yield in H_2O_2 to the dose, for different monomer concentrations, agree with the idea that acrylamide can react with H atoms and the OH radical which, otherwise, would catalyse the inverse reaction of the molecular products: $H_2 + H_2O_2 \rightarrow 2H_2O$; at concentrations 10^{-2}M, the acrylamide also agrees with the precursors of oxygenated molecular water, thus reducing the quantity of H_2O_2 formed. In acid solutions, the cross chains of polyacrylamide are oxidized and end in ferric ions in a reaction which can be represented by $m_j^* + Fe(III) \xrightarrow{k'} t \rightarrow Pj + Fe(II)$, and if a sufficient quantity of ferric perchlorate is added, the reaction of mutual termination is completely suppressed. The expression for velocity then becomes $R_p = G_1 I K_p m_1/k'_t$ [Fe(III)]. (auth)

100

FORMATION OF OXYGENATED WATER BY THE ACTION OF GAMMA RADIATION ON THE AQUEOUS SOLUTIONS $O^{16}O^{18}-H_2O^{16}$. Edwin J. Hart, Sheffield Gordon, and Dwight A. Hutchison (Argonne National Lab., Lemont, Ill.). J. chim. phys. 52, 570-7(1955) July-Aug. (In French)

The kinetics of the formation of oxygenated H_2O by the action of γ radiation on aqueous solutions containing O^{18}-enriched oxygen were studied. The primary products of radiation are oxygenated H_2O and normal O^{16}, and oxygenated water containing O^{18}-enriched oxygen. The yield of normal oxygenated water is independent of pH between pH=

0.4 and 9.65. The radiochemical yield of enriched oxygenated H_2O decreases when pH increases, and the yield of normal oxygen rises very rapidly for pH greater than 8.0. The results are evaluated as a function of the yields of free radicals and molecular products, assuming a random recombination mechanism of the HO_2 radicals. (tr-auth)

101

ACTION OF IONIZING RADIATION ON AQUEOUS SOLUTIONS OF OXALIC ACID. Ivan Draganic (Commissariat a l'Energie Atomique, France). J. chim. phys. 52, 595-9 (1955) July-Aug. (In French)

Aqueous aerated solutions of oxalic acid were irradiated in the reflectors of the French reactors and by Co^{60} γ rays. The radiolysis yield was studied as a function of the intensity of the radiation dose and of the concentration of oxalic acid in the solutions. Assuming $G_{Fe^{3+}} = 15.6$, it is found that for concentrations of oxalic acid varying from 50 to 700 m$\underline{M}$/l, $G_{H_2C_2O_4} = 4.9 \pm 0.4$ for Co radiation and 5.2 ± 0.5 in the reactor reflectors. Some results on the radiolysis of aerated solutions of uranyl oxalate from pile radiation are indicated. (tr-auth)

102

PARTIAL STUDY OF THE RADIOLYTIC DECOMPOSITION OF MONOALKYL PHOSPHATES IN AQUEOUS SOLUTION. R. W. Wilkinson and T. F. Williams (Atomic Energy Research Establishment, Harwell, Berks, England). J. chim. phys. 52, 600-15(1955) July-Aug. (In French)

The action of ionizing radiations on the aqueous solutions of some simple monoalkyl phosphoric esters has been studied with 1-Mev electrons and Co^{60} γ radiation. In the presence of oxygen at pH = 8, inorganic phosphates, acyl phosphates, oxygenated H_2O, and an aldehyde are formed at the same time. A mechanism is proposed for the decomposition of methyl and ethyl esters which quantitatively takes account, at pH = 8, of the yields of primary products formed by the radiolysis of water. When the length of the carbon chain is increased, the initial attack is no longer produced on only one of the carbon atoms, and a decrease of the acyl phosphate yield is observed though the yield of mineral phosphate remains constant from the ethyl derivative to the $\underline{n}$-amyl derivative. Also, in the case of $\underline{n}$-propyl, $\underline{n}$-butyl, and $\underline{n}$-amyl derivatives, a delayed effect is observed, whereby the mineral phosphate is slowly liberated. Proofs exist of the formation of hydroperoxides by irradiation of the $\underline{n}$-propyl phosphoric ester. In the absence of oxygen, the reproducibility of these results is not as good, and an intensity effect is observed. There is no production of acyl phosphate, and the delayed effect after irradiation of $\underline{n}$-propyl, $\underline{n}$-amyl phosphoric esters is not observed. The interpretation of these results is compatible with a mechanism forming only the OH radical. (tr-auth)

103

HOW RADIATION CHANGES POLYMER MECHANICAL PROPERTIES. C. D. Bopp and O. Sisman (Oak Ridge National Lab., Tenn.). Nucleonics 13, No. 10, 51-5(1955) Oct.

Consideration is given to mechanisms of deformation caused by radiation-induced cross linking in high polymers. Stress-strain curves are given for reactor-irradiated nylon, natural rubber, vinyl chloride acetate, lucite, and butyl rubber. (B.J.H.)

Refer also to abstracts 31, 39, 442, and 445.

RARE EARTHS AND RARE-EARTH COMPOUNDS

104

THE KINETICS AND MECHANISM OF THE REACTION BETWEEN CERIUM(III) AND PERSULPHATE. Sture Fronaeus and Carl Otto Östman (Univ. of Lund, Sweden). Acta Chem. Scand. 9, No. 6, 902-11(1955).

The kinetics of the thermal decomposition of $S_2O_8^{2-}$ in aqueous solutions and of the redox reaction between Ce^{3+} and $S_2O_8^{2-}$ are investigated in a perchlorate ionic medium and in a mixed perchlorate-sulphate medium. It is found that the oxidizing agent in the redox agent in the redox reaction is the intermediate radical ion SO_4^-, formed in a decomposition reaction of $S_2O_8^{2-}$ that is uncatalyzed by H^+. Evidence is also given that only one SO_4^- can be formed from every $S_2O_8^{2-}$ decomposing in this way. The mechanism previously proposed for the persulphate decomposition is changed so as to be consistent with these results. The fact observed that cerous sulphate complexes are oxidized more rapidly than the hydrated Ce^{3+} is discussed in terms of an electron transfer mechanism. (auth)

SEPARATION PROCEDURES

105   ORNL-1900
Oak Ridge National Lab., Tenn.
CHEMISTRY IN THE ELECTROMAGNETIC SEPARATION OF PLATINUM ISOTOPES. W. C. Davis and C. W. Sheridan. May 17, 1955. 8p. Contract W-7405-eng-26.

The chemistry of platinum is reviewed in relation to its application to the preparation of charge materials, the chemical refinement of the electromagnetically separated isotopes, and the recovery of residues. (auth)

106   PDB-139
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
FINAL PURIFICATION OF CESIUM-137. PART II. PILOT PLANT INVESTIGATION OF AMBERLITE IR-100 RESIN. K. G. Heal and F. G. Crouch. Dec. 1954. 24p.

A 20-in. column of Amberlite IR-100H resin has a capacity of 7.95 mg cesium/ml resin with simulated feed from the Family Separation process. Ninety-five percent of the cesium applied to the column is recovered in a 1$\underline{N}$ nitric acid product. The cesium feed is purified in respect to total solids by a factor of 85, giving a product of 3 curies of cesium-137 per gram total solids. A block flowsheet is presented for final purification of cesium on Duolite C-3 resin. Resin capacity and product purity are the same for the above Duolite and Amberlite resins. A 7-litre resin column 29 inches in height should purify 665 curies of cesium in less than a week and yield 600 curies as product. (auth)

107   RMO-2505
Rohm and Haas Co. Research Labs., Philadelphia.
RECOVERY AND PURIFICATION OF URANIUM BY ION EXCHANGE. Progress Report for January 1, 1952-April 1, 1952. Robert Kunin. Apr. 15, 1952. Decl. Sept. 23, 1955. 27p. Contract AT(49-1)-535.

A rapid method has been devised for testing the relative effectiveness of ion exchange resins in uranium recovery. This test procedure is now being applied to a series of resins consisting of more than 100 anion and cation exchange resins. Detailed studies have been made on the use of ion exchange membranes for the treatment of Western

Reef barren effluent, ion exchange U eluate, Climax leach liquor, and carbonate leach liquor. The electrochemical process involved in the use of these ion exchange membranes appears to be very economical and offers advantages over the usual chemical methods. These advantages include recovery of leach solutions, ease of handling of precipitates, and low cost. A preliminary survey has been made of the use of various reagents for improving coagulation and filtration of the phosphate slimes encountered in the Florida phosphate deposits. Certain amines and salts of acrylic acid have been found to be very effective. The use of electro-endosmose for the dewatering of the phosphate slime concentrates has been suggested. (auth)

108 AEC-tr-2285
SEPARATION, BY ION EXCHANGE, OF TRACES OF ACTINIUM-227 FROM A LARGE AMOUNT OF LANTHANUM. Yang Jeng Tsong. Translated by K. S. Bevis from J. chim. phys. 47, 805-6(1950). 3p.

A column of ion exchange resin (Amberlite IR-100) and an eluant of 0.5% ammonium citrate (pH = 5.5) was used to separate 3 μc of Ac^{227} from 200 mg of La. (auth)

Refer also to abstracts 78, 109, 117, and 209.

SORPTION PHENOMENA

109 ISC-536
Ames Lab., Ames, Iowa.
THE INFERENCE OF ADSORPTION FROM DOUBLE LAYER CAPACITANCE MEASUREMENTS. Bert H. Clampitt and Robert S. Hansen. [Oct. 27, 1954]. 13p. Contract [W-7405-eng-82].

The apparent isotherms for the adsorption of n-caproic acid, n-heptylic acid, n-octanoic acid, heptanol-$\bar{1}$, and n-heptaldehyde from 0.1$\underline{M}$ aqueous perchloric acid solution by Ag and Cu were obtained from double-layer capacitance measurements. Results are compared with corresponding results for these systems obtained by steady state current-overvoltage measurements. It is shown that the apparent isotherms can be reasonably interpreted as actual adsorption isotherms. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

110
THE HANDLING OF PLUTONIUM IN LABORATORIES: PRECAUTIONS. H. J. Dunster and E. J. Bennellick (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics 6, 312-20(1955) Oct.

Laboratory facilities and procedures for handling Pu at levels up to 10 curies are outlined. Glove box operation and maintenance are discussed. A procedure for the determination of Pu in urine is described. Emergency measures are suggested. (C.W.H.)

URANIUM AND URANIUM COMPOUNDS

111
COLORIMETRIC ESTIMATION OF URANIUM WITH AMMONIUM THIOCYANATE AND ITS APPLICATION TO DETERMINATION OF URANIUM IN MINERALS PARTICU-

LARLY MONAZITE CONCENTRATES. Mahadeo M. Tillu, D. V. Bhatnagar, and T. K. S. Murthy (Atomic Energy Establishment, Bombay, India). Proc. Indian Acad. Sci. A42, 28-35(1955) July.

The ammonium thiocyanate method can be used for the estimation of U in low grade ores after the preliminary isolation of U by ether extraction of the nitrate. A rapid method for the estimation of U in monazite concentrates is also described. (auth)

112
DIE METALLISCHEN ROHSTOFFE. 10 HEFT. URAN (The Metallic Raw Materials. Vol. 10. Uranium). E. Kohl. Stuttgart, Ferdinand Enke, 1954. 234p. (In German)

This book, Volume 10 of a series on metallic raw materials, especially their occurrence and industrial significance, covers general information on uranium. Properties, occurrence, origin, recovery, processing, applications, history, supply, and market value are discussed. The countries where it is mined are listed. (J.E.D.)

113
THE CRYSTAL STRUCTURE OF TRIGONAL U_3O_8. Stanley Siegel (Argonne National Lab., Lemont, Ill.). Acta Cryst. 8, 617-19(1955) Oct. (In English)

The orthorhombic form of U_3O_8 is stable to about 400°C. At this temperature, U_3O_8 transforms to a trigonal modification. The unit-cell dimensions are a = 6.801 ± 0.001, c = 4.128 ± 0.001 kX. For one molecule in the cell the calculated density at the transition temperature is 8.41 g/cm^{-3}. With the assumed oxygen positions, the space group becomes $P3 - C_{3i}^1$. This leads to $U_I - 6O = 2.31$ A, $U_{II} - 6O_I = 2.31$ A, and $U_{II} - 2O_{II} = 2.06$ A. (auth)

114
THE HYDRATES OF THORIUM TETRAFLUORIDE. R. W. M. D'Eye and G. W. Booth (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 1, 326-33(1955) Oct.

From a chemical, tensimetric, and x-ray crystallographic study three hydrates of ThF_4 have been identified. The highest hydrate found, $ThF_4 \cdot 2.5$ to $3.0H_2O$, is pseudo-tetragonal, and can be thermally degraded to $ThF_4 \cdot 0.25H_2O$. The intermediate hydrate has a composition varying from $ThF_4 \cdot 0.5$ to $2.0H_2O$, and is orthorhombic with sixteen molecules per unit cell. The water molecules in this structure are not all crystallographically equivalent. This hydrate can be thermally degraded to $ThF_4 \cdot 0.25H_2O$. The lowest hydrate, $ThF_4 \cdot 0.25H_2O$, when heated in air or vacuum at 300°C, gives anhydrous ThF_4. X-ray crystallographic data are given for ThF_4 and $UF_4 \cdot 2.5H_2O$. (auth)

Refer also to abstract 107.

WASTE DISPOSAL

115 IDO-14334
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
EXPERIENCE OF HANDLING LOW LEVEL ACTIVE LIQUID WASTES AT THE IDAHO CHEMICAL PROCESSING PLANT. S. F. Fairbourne, D. G. Reid, and B. R. Kramer. June 17, 1955. 61p. Contract AT(10-1)-205.

Presented are the results of the first two years experience with low-level radioactive waste handling equipment at the Chemical Processing Plant. Included are mechanical

evaluation, changes made to the equipment, quantity and sources of the various types of wastes handled, costs of processing, and the results of the effects of various process variables on decontamination during evaporation. (auth)

116   MLM-232
Mound Lab., Miamisburg, Ohio.
PILOT PLANT WORK ON SOLID BURNABLE WASTE DISPOSAL FOR MOUND LABORATORY. (INFORMATION MEETING PAPER NO. 12). P. J. Schauer. Nov. 1, 1948. Decl. Mar. 31, 1955. 14p. Contract AT-33-1-Gen-53.

ENGINEERING

117   AECD-3683
Knolls Atomic Power Lab., Schenectady, N. Y.
A MINIATURE PILOT PLANT FOR HIGH LEVEL SEPARATIONS PROCESSES. B. V. Coplan and J. W. Codding. [1954?]. Decl. Sept. 20, 1954. 12p. Contract [W-31-109-Eng-52].

The design and operation of "Mini" units, miniature pump-mix mixer settlers, which are small-scale models of pilot plant solvent extraction contactors, are reviewed. Three "Mini" units in cascade, combined with a small-scale dissolver and feed preparation facility, provide a miniature plant which can be built at a fraction of the cost of that associated with semi-works construction, and can be used to obtain data comparable to that from pilot plant runs. (C.W.H.)

118   CCC-1024-TR-142
Wisconsin. Univ., Madison.
A SMALL GRAPHITE FURNACE FOR TEMPERATURES UP TO 3000°K. J. L. Margrave, R. C. Emmons, J. R. Soulen. Oct. 12, 1955. 14p.

A resistance-heated graphite furnace useful to 3000°K was constructed for use in the study of systems containing boron oxides. The heating element consists of a $1\frac{3}{16}$ in. I. D. graphite helix with a $\frac{1}{8}$ in. wall which provides a hot zone 3 in. in length. By using refractory oxide reaction tubes mounted concentrically inside the heating element an oxidizing atmosphere can be maintained at temperatures above 2000°C. The maximum temperature of the furnace can be obtained using graphite reaction tubes and a neutral or reducing atmosphere. (auth)

119   KAPL-1384
Knolls Atomic Power Lab., Schenectady, N. Y.
AN EVALUATION OF PIPING ANALYSIS METHODS. K. L. Hanson and W. E. Jahsman. Aug. 10, 1955. 65p. Contract [W-31-109-Eng-52].

The purpose of the review is to describe and compare various methods of piping analysis, particularly as they are amenable to new developments in the field (such as flexibility and stress intensification), and to recommend the one(s) flexible enough to accommodate these developments yet simple enough for general application. To accomplish this purpose, the report is divided into five parts: (1) description and comparison of methods, (2) flexibility effects, (3) stress analysis, (4) conclusions and recommendations, and (5) appendixes, in which the derivation and application of the recommended method are described. Discussion will be limited to elastic reactions caused by thermal expansion of piping systems which are composed of tangents and bends and are supported rigidly or by restraints with known flexibility. (auth)

120   NP-5779
Mine Safety Appliances Co., Callery, Penna.
PROGRESS REPORT NO. 30 FOR AUGUST AND SEPTEMBER 1955. W. J. Posey, ed. Oct. 11, 1955. 78p. Contract NObs-65426.

The results of tests on models of the Submarine Intermediate Reactor Mark B 3000-kw steam generators are reported. Data from steady state and cyclic operation have been obtained. The system has been shut down for cleaning, inspection, and repairs. Heat transfer with liquid metals flowing perpendicular to tube bundles is being studied, and some performance data are presented. An induction pump for liquid metals has been designed using the principle of the watt-hour meter. Tests are being performed to determine conditions influencing the low temperature wetting of surfaces with alkali liquid metals. The testing of valves and bellows for use in the SIR sodium system is described. Mockups have been constructed of the expansion tank and other components in the Mark B Na system. Tests are being performed on them to determine the effects of the use of impure N containing 2 vol. % O as a cover gas for the Na system. Methods of leak plugging are being studied for water to mercury leaks in the Mark A steam generating system. The removal of residual radioactive Na from a cooling system by means of Na flushes is being studied using Au^{198} as a tracer. The study of radiation hazards arising from leaks in a simulated contaminated water cooling system of a nuclear reactor is continuing. (For preceding period see NP-5739.) (M.P.G.)

121
MASS TRANSFER IN PACKED BEDS. R. W. Fahien and J. M. Smith (Purdue Univ., Lafayette, Ind.). A.I.Ch.E. Journal 1, 28-37(1955) Mar.

Although considerable work has been done on the problem of heat transfer radially in fixed beds through which gases are flowing, the data available for mass transfer are limited to one pipe size and one packing size and refer to average diffusivities for the entire bed. The present study was undertaken to determine: (1) diffusivities over a range of pipe and packing sizes and (2) the effect of radial position in the bed. The measurements were made by introducing carbon dioxide into an air stream and analyzing the resultant mixture at various positions in the bed downstream from the point of injection. Pipe sizes of 2, 3, and 4 in. were packed with spherical particles of $\frac{5}{32}$-, $\frac{1}{4}$-, $\frac{3}{8}$-, and $\frac{1}{2}$-in. nominal diameter. The results show that the Peclet number $D_p u/E$ increases from the center toward the wall of the pipe and that the increase is significant when D_p/D_t is greater than 0.05. Empirical correlations are then presented for both point Peclet numbers, which vary with radial position, and average Peclet numbers for the entire bed. The variations in Peclet number with radius can be explained in terms of the corresponding variation in void fraction for 81% of the radius of the bed. At modified Reynolds numbers above 40 to 100 the equation $Pe = 8.0 + 100 (\delta - \delta_0)$ correlates the effects of pipe and packing size and radial position. At radial positions greater than 0.81 wall friction influences turbulence conditions and the Peclet number. (auth)

122
HIGH-VACUUM BUTTERFLY VALVE. R. E. Holland and

F. P. Mooring (Argonne National Lab., Lemont, Ill.).
Rev. Sci. Instr. 26, 989(1955) Oct.

This valve of large effective aperture consists of a brass block valve body bored to receive the valve plate and stem with an "O" ring groove cut in the edge of the valve plate to provide a seal between it and the body. The center line of the valve stem is offset from the center plane of the valve plate by an amount determined by the plate thickness and stem diameter. In addition, the stem is displaced from the valve body center line by the same amount so that the valve plate is centered in the body in the open position. An "O" ring on the valve stem seals it to the valve body. A spring-loaded pin in the handle engages holes in the body so as to lock the valve in the open and closed positions. (auth)

123

SOME ASPECTS OF THE EUROPEAN ENERGY PROBLEM.
Louis Armand. Paris, Organisation for European Economic Co-operation, June 1955. 63p. $1.00.

Problems relating to fuel and power potentials in European countries are reviewed. The availability and feasibility of utilizing coal gas, natural gas, nuclear power, and hydroelectric power are discussed. (C.H.)

HEAT TRANSFER AND FLUID FLOW

124   AD-38637
Michigan. Univ., Ann Arbor. Engineering Research Inst.
SURVEY OF POROUS-WALL HEAT-TRANSFER LITERA-TURE. J. E. Broadwell and P. Sherman. Apr. 1953. 34p. Project M992-7. Contract AF 18(600)-51.

Brief summaries of papers pertaining to porous-wall heat transfer are presented. The papers, reporting both experimental and analytical work, deal with transpiration cooling. The survey was made in connection with a study of the de-icing or anti-icing of airplanes by the injection of a hot fluid through a porous section of the surface to be protected. (auth)

125   AECU-2979
Los Alamos Scientific Lab., N. Mex.
[TAYLOR INSTABILITY OF INCOMPRESSIBLE LIQUIDS]. PART 1. TAYLOR INSTABILITY OF AN INCOMPRESS-IBLE LIQUID. Enrico Fermi. Sept. 4, 1951. PART 2. TAYLOR INSTABILITY AT THE BOUNDARY OF TWO IN-COMPRESSIBLE LIQUIDS. Enrico Fermi and John von Neumann. Aug. 19, 1953. 13p. Contract W-7405-eng-36.

A discussion is presented in simplified form of the problem of the growth of an initial ripple on the surface of an incompressible liquid in the presence of an acceleration, g, directed from the outside into the liquid. The model is that of a heavy liquid occupying at $t = 0$ the half space above the plane $z = 0$, and a rectangular wave profile is assumed. The theory is found to represent correctly one feature of experimental results, namely the fact that the half wave of the heavy liquid into the vacuum becomes rapidly narrower while the half wave pushing into the heavy liquid becomes more and more blunt. The theory fails to account for the experimental results according to which the front of the wave pushing into the heavy liquid moves with constant velocity. The case of instability at the boundary of 2 fluids of different densities is also explored. Similar results are obtained except that the acceleration of the heavy liquid into the light liquid is reduced. (M.P.G.)

126   AERE-E/R-173
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
FLOW OF A COMPRESSIBLE COOLANT THROUGH A CHANNEL. J. Woodrow. Feb. 10, 1948. Decl. (with Amendments) June 28, 1951. 21p.

The general problem of the flow of a gas along a channel, with small variation in cross section and a given heat-input distribution, is considered, allowing for compressibility and friction. Working in terms of the density of the gas, a differential equation for the flow is obtained. An analytical solution of this equation is obtained for the special case of uniform heat input into a uniform channel. Numerical ex-amples for medium-velocity air and high-velocity steam, indicate that the state of the gas at the exit is mainly determined by the overall heat input, and not by its dis-tribution. The special solution therefore gives an excellent approximation if the mean heat input is used in calculating the state at the exit. (auth)

127   BAC-02-978-010
Bell Aircraft Corp., Buffalo.
SKIN FRICTION AND HEAT TRANSFER IN COMPRESS-IBLE LAMINAR FLOW WITH ARBITRARY PRESSURE AND SURFACE TEMPERATURE GRADIENTS. Deane N. Morris and John W. Smith. Sept. 15, 1952. 133p. Project MX-1677B. Contract W33-038-ac-20063.

The boundary layer equations for two-dimensional compressible laminar flow are solved by an extension of the methods of Karman-Pohlhausen and Dorodnitsyn. The surface temperature variation and the pressure gradient are arbitrary, and the viscosity law and Prandtl number are unspecified, although the latter must be constant. The results appear in the form of simultaneous ordinary differential equations for the velocity and thermal boundary layers, which can be evaluated readily by numerical integration. Solutions by the present method are compared with more exact solutions in the special cases for which the latter are available, and the agreement is good in all cases. The special cases used for comparison include skin friction for incompressible retarded flow, skin friction and heat transfer for incompressible flow over a special cylindrical shape, and skin friction and heat transfer for compressible flow over a flat plate, with and without a surface temperature gradient. A sample problem is presented for a circular-arc airfoil at zero angle of attack in supersonic flow, with a specified surface temperature distribution. The local skin friction and heat transfer coef-ficients are determined as a function of distance along the surface, and compared with the results obtained by applica-tion of the common flat plate relations. (auth)

128   IDO-16074
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
TEMPERATURE AND STRESS FORMULAE FOR CYLIN-DERS WITH HEAT GENERATED IN THE MATERIAL. C. F. Leyse. Mar. 18, 1953. 7p. Contract [AT(10-1)-205].

General stress formulas for hollow and solid cylinders in which heat is generated in the material, e.g. in irradia-tions in a reactor are presented. (auth)

129   ORNL-1888
Oak Ridge National Lab., Tenn.
FREE CONVECTION THEORY AND EXPERIMENT IN FLUIDS HAVING A VOLUME HEAT SOURCE. D. C.

Hamilton and F. E. Lynch. Aug. 19, 1955. 71p. Contract W-7405-eng-26.

The free convection system investigated consisted of two channels formed by three parallel and equally spaced vertical plates. The two channels were filled with a dilute electrolyte in which heat was generated uniformly by electrical resistance heating. The heat was transferred from the two free convection channels to the outer plates, then through the outer plates to the coolant channels in which the coolant was flowing vertically upward. The significant measurement was the temperature difference between the center wall and the outer wall at a given vertical level. A laminar regime theoretical analysis was made based on the postulate that, in the middle region away from the ends, the velocity profile is fully established and the temperature is linear with the vertical coordinate. Semi-quantitative visual observations of the paths of suspended droplets indicated that the free convection flow circuit exists as one long cell and that the velocity profile is fully established in the middle region and similar to that predicted by the theory. The onset of turbulence occurred at a Grashof modulus equal to 5×10^9, which is the same as for ordinary free convection. For small values of the modulus, N_{III}, the vertical temperature gradient was uniform and the middle region laminar regime experimental temperature data were only 15% lower than the theory: for large values of N_{III} the vertical temperature gradient was not uniform and the temperature data were only 50% of the theoretical value. Above the critical value of Grashof modulus, the temperature data dropped sharply, due to turbulence, to about 66% of the laminar theory. In contrast to most convective heat transfer systems, the end region temperature differences near the top of the system were greater than those in the middle region. (auth)

130   ORNL-1933

Oak Ridge National Lab., Tenn.
APPLICATION OF TEMPERATURE SOLUTIONS FOR FORCED CONVECTION SYSTEMS WITH VOLUME HEAT SOURCES TO GENERAL CONVECTION PROBLEMS. H. F. Poppendiek and L. D. Palmer. Oct. 25, 1955. 37p. Contract W-7405-eng-26.

Previously developed mathematical temperature solutions for forced convection systems having volume heat sources within the fluids are applied to more general convection problems. Convection solutions are tabulated so that it is possible to determine the detailed radial temperature structure within fluids having uniform volume heat sources and being uniformly cooled at the duct walls. The detailed temperature profile of a specific system is presented. The derivation of equations describing the temperature structure and heat transfer rates in a duct system in which the wall is nonuniformly cooled is given, and the temperature structure of a specific heat exchange system is also presented. (auth)

131   PWAC-133

Connecticut. Univ., Storrs.
DETERMINATION OF SURFACE COEFFICIENTS OF HEAT TRANSFER AND PRESSURE DROP AND FRICTION FACTOR IN INTERNALLY FINNED TUBES WITH AIR FLOWING INTERNALLY. Cover carries title: MEASUREMENT OF HEAT TRANSFER COEFFICIENTS AND PRESSURE LOSSES FOR AIR FLOWING THROUGH INTERNALLY FINNED TUBES. Final Summary Report for the Period December 1, 1953 to March 31, 1955. Mechanical Engineering Dept. Charles H. Coogan, Jr., Winthrop E. Hilding, Henry H. Samuelson, and Peter W. McFadden. May 4, 1955. 59p. Submitted to Pratt and Whitney Aircraft Div. (Fox Project).

During this period eleven (11) eighteen inch by $\frac{1}{2}$ inch I. D. tubes, each with a different arrangement of internal fins, were tested. Experimental data recorded on each of these tubes include the measurement of the internal pressure drop over the test length with heat addition and also with essentially isothermal flow of air for each of the eleven tubes. Total heat flow was determined in the heating tests by means of temperature and air flow measurements for Reynolds' numbers ranging from $100 < R_E < 32,000$. Calculated data from the above measurements include the friction factor for both isothermal flow and flow with heating for each tube. The so called j factor has been determined for the tests with heating. The friction and j factors are plotted against Reynolds' number computed by using four times the hydraulic radius as the critical length dimension. A third dimensionless parameter was determined for the heating tests. This parameter gives the ratio of the heat transfer coefficient to the pressure drop per unit of tube length. The heat transfer coefficient used in this parameter has been calculated with reference to the internal diameter of the tube only. The resulting values of this parameter are plotted against a Reynolds' number computed using the inside tube diameter as the critical length dimension. (auth)

132   WADC-TR-53-288(Pt.6)

Ohio State Univ. Research Foundation, Columbus.
HEAT TRANSFER AND FRICTIONAL EFFECTS IN LAMINAR BOUNDARY LAYERS. PART 6. EFFECT OF VARIABLE PROPERTIES. Robert N. Thurston—Arthur N. Tifford, ed. Sept. 1953. 135p. Project No. 1366. Contract AF33(038)-10834. (AD-58607)

This report was originally prepared as the doctoral dissertation, "Contributions to Laminar Boundary Layer Theory for Gases," (1952).

The effects of the variation of fluid properties on boundary layer solutions when the pressure varies along the surface are investigated. The correspondence of boundary layer solutions for fluids having variable properties with solutions for fluids having constant properties is extended in an approximate manner so as to include the effect of Prandtl number different from unity. It is shown that power series solutions may be obtained for general viscosity-temperature relations. A new approximate treatment of skin friction is presented for cases in which there exists a large difference between the stagnation temperature of the gas and the surface temperature. (auth)

133   NACA-TM-1377

THE THEORY OF TURBULENCE. (Les Théories de la Turbulence). L. Agostini and J. Bass. Translated from Ministère de l'Air. Publications Scientifiques et Techniques, No. 237, 1950. 167p.

The report includes a discussion of the kinematics of statistical mediums, particularly those which are isotropic. A mathematical study is made of the applications of Navier's equations to turbulent motion. Physical theories involving similarity are dealt with. Review is made of much of the work in turbulence. The theoretical discussions are illustrated by some correlation and spectrum curves based on measurements taken in the wind tunnel at the laboratory of the mechanics of the atmosphere at Marseille. (auth)

134

HEAT AND MASS TRANSFER IN PACKED BEDS. Donald
A. Plautz and H. F. Johnstone (Univ. of Illinois, Urbana).
A.I.Ch.E. Journal 1, 193-9(1955) June.

Eddy mass diffusivities, effective thermal conductivities,
and wall heat transfer coefficients were measured in an
8-in. tube packed with $\frac{1}{2}$- and $\frac{3}{4}$-in. glass spheres. Super-
ficial mass velocities ranged from 110 to 1,640 lb./(hr.)
(sq.ft.), corresponding to modified Reynolds numbers of
100 to 2,000. Air was the main stream fluid in all cases.
The modified Peclet group ($D_p V/E^*_{td}$) was found to be
constant at a value of about 12 in the region of fully devel-
oped turbulence. At lower Reynolds numbers this group
varied with the flow rate. Effective thermal conductivities
were correlated by an equation. Modified Peclet numbers
for heat transfer were about 25% less than those for mass
transfer. The wall heat transfer coefficient varied with the
superficial mass velocity as $h_w = 0.090(G_0^{0.75})$. An explana-
tion is suggested for the similarity in velocity dependence
between these values and those for turbulent flow in an
empty tube, based on channeling at the wall. (auth)

135

DIFFUSIONAL FILM CHARACTERISTICS IN TURBULENT
FLOW: DYNAMIC RESPONSE METHOD. John J. Keyes,
Jr. (Union Carbide Nuclear Co., Oak Ridge, Tenn.).
A.I.Ch.E. Journal 1, 305-11(1955) Sept.

Application of a dynamic or unsteady-state technique to the
problem of radial mixing in a tube is described. Measure-
ment of the amplitude attenuation suffered by a sinusoidally
modulated gas composition wave as it flows within an open
(unpacked) tube makes possible the direct determination of an
"equivalent gas film thickness" from which a mass transfer
film coefficient may be readily calculated. A brief summary
of the method employed for obtaining tne necessary mathe-
matical relationships is presented, along with descriptions
of the techniques developed for measurement of small
amplitude differences at wave frequencies as high as 10
cycles/sec. Experimentally, conditions were varied to in-
clude a range of Schmidt number from 0.18 to 1.24 and of
Reynolds number from 4,000 to 50,000. The results of this
work appear to fall nearly in line with the semitheoretical
equation of Martinelli as written for mass transfer.
Generally speaking, α was found to be an increasing function
of N_{Sc}, varying from about 0.5 to a maximum of 0.77; β, in
turn, was found to increase with N_{Re} from 0.3 to 0.5. A
suggestion for extending the method to measurement of eddy
diffusivities in the axial direction is included. (auth)

136

MECHANSIM OF HEAT TRANSFER TO FLUIDIZED BEDS.
H. S. Mickley and D. F. Fairbanks (Massachusetts Inst. of
Tech., Cambridge). A.E.Ch.E. Journal 1, 374-84(1955)
Sept.

In order to determine the nature of the resistance con-
trolling heat transfer between fluidized beds and surfaces in
contact with them, heat transfer measurements were made
on the same solid constituents with several different
fluidizing gases. The heat transfer coefficients obtained
with fluidized beds are found to be proportional to the
square root of the thermal conductivity of the quiescent
beds. This result indicates that the process controlling
fluidized heat transfer may be considered to be an unsteady-
state diffusion of heat into mobile elements of quiescent bed
material. This picture is analyzed mathematically to yield

an equation for the heat transfer coefficient $h = \sqrt{\kappa_m \rho_m c\, S}$
wherein the effects of the bed thermal properties are
separated from the effects of the stirring factor S, which
accounts for bed motion and geometry. The mass transfer
analogue is also derived and shown to correlate existing
mass and heat transfer data reasonably well. It is con-
cluded that the proposed mechanism yields a satisfactory
picture of the fluidized heat transfer process and may
provide the beginnings of a rational approach to the corre-
lation and prediction of fludized heat transfer in engineering
work. (auth)

137

MEASUREMENT OF HEAT TRANSFER COEFFICIENT
FROM GAS FLOW IN FURNACE CHARGES HEATED
UNDER NON-ADIABATIC CONDITIONS. I. B. N. Vetrov
and O. M. Todes. Zhur. Tekh. Fiz. 25, 1217-31(1955) July.
(In Russian)

A simple method is given for comparing the experimental
curves of relative heat dependencies on time with the theo-
retical curves obtained from heating the furnace charges by
inflow of gas in non-adiabatic conditions. Experiments and
formulas to determine the volume coefficient of heat trans-
fer over a wide wave front are demonstrated. (R.V.J.)

138

INITIAL HEATING RESULTING FROM LONGITUDINAL
HEAT-CONDUCTIVITY OF GRANULAR MATERIAL
PLACED IN A PIPE UNDER NON-ADIABATIC CONDI-
TIONS. II. B. N. Vetrov and O. M. Todes. Zhur. Tekh.
Fiz. 25, 1232-41(1955) July. (In Russian)

Experiments with several pipes filled with granular
material (pellets, shot, or quartz sands) confirmed the theo-
retical calculations proving that the longitudinal heat con-
ductivity continues along the length of a pipe filled with
granular material (or solid bar) when one end of the pipe is
heated while a side surface undergoes cooling. The height
of the heat wave diminishes according to the exponential
law. Regularity and the basic characteristics of the heat
wave are developed. The longitudinal heat conductivity is
analogous to that of the heat wave transmission in the
furnace load heated by the inflow of gas. (R.V.J.)

139

CONVECTION OF HEAT WAVE IN INITIAL HEATING BY
GAS FLOW IN FURNACE CHARGES. III. B. N. Vetrov
and O. M. Todes. Zhur. Tekh. Fiz. 25, 1242-47(1955) July.
(In Russian)

A general case is discussed concerning the heat exchange
between the gas flow and the furnace load in non-abiadatic
conditions, considering the heat convection created by the
heat conductivity along the layer of the furnace load.
(R.V.J.)

140

CERTAIN QUANTITATIVE CHARACTERISTICS OF
TRANSITION FROM LAMINAR TO TURBULENT FLOW IN
BOUNDARY LAYER. L. M. Zysina-Molozhen. Zhur. Tekh.
Fiz. 25, 1288-96(1955) July. (In Russian)

Experimental investigations are presented concerning the
development of the boundary layer along the laminar surface
streamlined by non-gradient flow and a flow with longitu-
dinal gradient of pressure. Another flow, on the lattice
profile, permits the determination of some quantitative
characteristics of the expansion in the transition area.
(R.V.J.)

MATERIALS TESTING

141 AD-37256
Illinois. Univ., Urbana.
THE USE OF FOIL GAGES TO MEASURE LARGE STRAINS
UNDER HIGH FLUID PRESSURES. Technical Report No.
1 on INVESTIGATION OF THE BEHAVIOR OF OVER-
STRAINED THICK-WALLED CYLINDERS. M. C. Steele
and L. C. Eichberger. July 1954. 28p. ORD Project
TB2-0001-(1070). Contract DA-11-022-ORD-1527.

A foil-type resistance strain gage was tested in a series
of four experiments in order to establish the suitability of
such instruments for large strain measurements, under
conditions of high fluid pressure. The foil gage consists of
a printed circuit of sheet or ribbon Cu−Ni alloy from which
the excess metal was removed by etching. Tests were
conducted within a cylinder where fluid pressures up to
20,000 psi were imposed. Permanent effects due to the
fluid pressures were negligible, and the gage was generally
found to be satisfactory in most respects. (K.S.)

142 WADC-TR-54-582
Cornell Aeronautical Lab., Inc., Buffalo.
COMPRESSIVE-CREEP PROPERTIES OF HIGH-TEM-
PERATURE MATERIALS. L. A. Yerkovich and G. J.
Guarnieri. Nov. 1954. 53p. Project 7351. Contract
AF33(616)-245.

An investigation concerning the behavior of high-temper-
ature alloy and metal−ceramic materials was conducted
to provide data regarding the creep characteristics of the
test materials when subjected to static compression
stresses in the temperature range of 1350 to 1800°F. All
pertinent details relating to test equipment including
loading apparatus, temperature control and measurement,
and techniques for measuring creep strain in compression
are discussed. Data obtained on the test materials for
selected compressive stresses are presented in tabular
and chart form to demonstrate the relationship of time vs.
total deformation and stress vs. time for various amounts
of creep strain and total deformation. In addition, tension-
creep characteristics, where available, are presented in
graphical form with corresponding compression-creep
results to provide a correlation illustrating the behaviors
of the test materials as influenced by the type of high-
temperature stress applied. Comparisons of the tensile
and compression creep behaviors of the test alloys indicate
that metals as well as metal−ceramic composites do not
necessarily behave identically under static tension and
compression stresses. (auth)

RADIOGRAPHY

143
TUBE WALL THICKNESS GAUGE WITH SELECTION OF
BACKSCATTERED γ-RADIATIONS. J. L. Putman, S.
Jefferson, J. F. Cameron, J. P. Kerry, and E. W. Pulsford
(Atomic Energy Research Establishment, Harwell, Berks,
England). J. Sci. Instr. 32, 394-8(1955) Oct.

A gage is described in which γ rays scattered back from a
thickness of metal are distinguished from primary γ rays by
virtue of their reduced energy. The selection is achieved
by using a scintillation counter with a sodium iodide
phosphor as detector, followed by a single channel kicksorter
as energy selector. The need for screening is thus eliminated

and the source and detector can be mounted close together.
This results in a light-weight measuring head, capable of
very local measurement of thickness. The electronic circuit
is arranged to permit single compensation for source decay
so that constant calibration is preserved when using a Co^{60}
source. The instrument is suitable for measuring the tube
wall or plate thicknesses up to $^{1}/_{8}$ in. of steel and is particularly
useful in detecting corrosion pitting in tubes. (auth)

VACUUM SYSTEMS

144
AN IMPROVED HIGH-CONDUCTANCE COLD-TRAP. A. J.
Martin (United Kingdom Atomic Energy Authority,
Aldermaston, Berks, England). J. Sci. Instr. 32, 400-1(1955)
Oct.

A high-conductance baffle cold trap for use with diffusion
pumps in vacuum systems is described. The conductance of
the cold trap was determined as 150 liters/sec for air at 20°C.
(C.W.H.)

MINERALOGY, METALLURGY, AND CERAMICS

145 BIOS-FR-896
British Intelligence Objectives Sub-Committee.
THE MANUFACTURE OF ZIRCONIUM−POTASSIUM
FLUORIDE, ZIRCONIUM OXIDE AND ZIRCONIUM
OXYCHLORIDE. W. Ivory. [nd]. 7p. (ATI-63671)

Manufacturing processes for zirconium potassium fluo-
ride, zirconium oxide, and zirconium oxychloride, as
carried out by the Auer plant, Berlin, are outlined. The
final output of K_2ZrF_6 is about 340 kg, with about 50% of
ZrO_2. Final recovery of ZrO_2 is about 50% of the ore
content. The finished zirconium oxychloride contains
about 34% ZrO_2, and the recovery is approximately 70%
of the ZrO_2 in the ore. (ASTIA-abst.)

CORROSION

146 AECU-3087
Los Alamos Scientific Lab., N. Mex.
MATHEMATICAL STUDIES ON GALVANIC CORROSION.
PART IV. INFLUENCE OF ELECTROLYTE THICKNESS
ON THE POTENTIAL AND CURRENT DISTRIBUTIONS
OVER COPLANAR ELECTRODES USING POLARIZATION
PARAMETERS. James T. Waber and Bertha Fagan.
[1954]. 61p. Contract [W-7405-eng-36].

Extensive numerical evaluation has been performed on
a Fourier series derived for the potential distribution in
an electrolyte lying above a plane containing infinitely
long, narrow electrodes juxtaposed and arranged in an
infinitely, alternating array with even symmetry. In con-
trast to the previous studies in this series, the limitation
that the electrolyte has finite depth has been imposed.
Eight perspective drawings of the reduced potential func-
tion have been made to scale to illustrate the variation of
the potential throughout the solution. A practical rule was
established for deciding from the behavior of the electro-

chemical system what effectively is an "infinite thickness" of the electrolyte. The variation of the current density over the anode has been evaluated for several different combinations of relative thickness b/c and of relative polarization parameter α/c. When b/c is small the major part of the corrosion current is concentrated into the vicinity of the anode-cathode junction provided that the electrical resistance of corrodent is not too high, or the polarization too strong, i.e., provided that α is relatively small in comparison with c. Eight graphs of $C_a^*(x)$ have been included to illustrate the effects of the several important dimensionless groups (a/c), (b/c) and (α/c). Comparison with published experimental data has been made and the agreement is reasonably good. Detailed discussion of the influence of the several factors is also presented. (auth)

147 NYO-3499

Arcos Corp., Philadelphia.

THE WELDING OF TYPE 347 STEELS. THE RESULTS OF NITRIC ACID AND COPPER SULFATE–SULFURIC ACID TESTS ON MODIFIED TYPE 347 WELD DEPOSITS. Lorin K. Poole. July 28, 1955. 23p. Contract [AT(30-1)-1233].

The results of nitric acid and copper sulfate – sulfuric acid tests of a standard partially ferritic Type 347 weld deposit were compared with four modified Type 347 and one Type 308ELC weld compositions. The highest corrosion rates of partially ferritic Type 347 weld deposits are observed when heat treated in the range of 1100 to 1300°F. Acceptable rates are observed as-welded and after heat treatment at 1550°F or higher. Optimum rates are observed after heat treatment at 1700°F and higher. After sensitizing at 1250°F, the rates are acceptable; annealing at 1950°F prior to exposure to the sensitizing temperature reduces this corrosion rate by about half. No integranular attack was observed in any of the partially ferritic welds. The substitution of tantalum for a portion of the columbium had no affect on corrosion resistance. Fully austenitic Type 347 weld deposits show extremely high corrosion rates when heat treated at 1100°F or sensitized at 1250°F; they also show moderately high rates when heat treated at 1300°F. Acceptable rates are observed as-welded and after heat treatment at 1550°F or higher. Optimum results are obtained after heat treatment at 1700°F or higher. Annealing at 1950°F prior to sensitizing at 1250°F reduces the corrosion rate of the sensitized specimens to an acceptable level. Intergranular attack was noted after heat treating in the range of 1100 to 1300°F. Very slight intergranular attack was also noted in the as-welded conditions. The Type 308ELC weld deposit shows the best corrosion resistance of all compositions tested, except when sensitized following an anneal at 1950°F. (auth)

GEOLOGY AND MINERALOGY

148 RME-1049

Division of Raw Materials, AEC.

PRELIMINARY RECONNAISSANCE OF PARTS OF THE SHIRLEY BASIN; ALBANY, CARBON AND NATRONA COUNTIES, WYOMING. Edward W. Smith. Sept. 20, 1954. 12p.

Preliminary radiometric reconnaissance of the Shirley Basin Area is reported. The abnormal radioactivity found,

was associated with Mn ore at the Decoration No. 1 Lode mine. (J.E.D.)

149 RME-3106

Pennsylvania State Univ., University Park.

PETROGRAPHICAL INVESTIGATIONS OF THE SALT WASH SEDIMENTS. Progress Report [for] April 1 to October 1, 1954. Div. of Mineralogy. J[ohn] C. Griffiths, J. A. Cochran, D. W. Groff, and J. S. Kahn. Dec. 1954. 98p. Contract AT(30-1)-1362.

Investigations into the general petrographic background of ore-bearing sediments in the Salt Wash member of the Morrison formation are completed. The first part is an introduction to the problem and a discussion of the physical and chemical characteristics of the ore-bearing sediments. Part II is concerned with the use of bulk density measurements to characterize the ore-bearing sediments. The bulk density variation was investigated to form a quantitative basis for sampling the sediments but the stratification of the sediments into units either on the basis of lithology or cementation failed to increase the efficiency of the sampling pattern. Part III describes an investigation into the grain packing of the sediments and establishes that the packing in sediments near an ore-bearing sandstone zone is different from that in a barren sandstone. This analysis serves to confirm the nature of the physical attributes of the ore trap; the emphasis is on textural arrangement which is different in the ore-zone from the barren zone sediments. Part IV describes the results of dye testing the sediments both in the field and the laboratory. This simple test appears to be an effective tool for use in the correlation of mudstone horizons. The results accruing from a field excursion over the Colorado Plateau and the implications of lithological description in the field are described. Part VI is concerned with semiquantitative spectrographic analysis of ore-bearing sediments and mudstones from the well cores of Bull Canyon. The concentration of these elements appears to be somewhat higher than would be expected in average sediments and suggests that the sedimentary rocks on the Colorado Plateau are unusually rich in "trace" elements. It may be concluded that on the basis of a very considerable background of petrographic information on the Salt Wash sediments the differences between ore-bearing and barren sediments are differences of degree not kind. The problem of locating ore in the Salt Wash member reduces to the selection of suitable criteria for differentiating the ore-bearing from barren sediments. These criteria must be capable of being measured by techniques which possess a reasonably high degree of precision and the criteria must be related to the characteristics which are associated with ore in the sediments. (auth)

150 RME-3110(Pt. 1)

Columbia Univ., New York.

ANNUAL REPORT FOR JUNE 30, 1954 TO APRIL 1, 1955. PART I. THE CHEMICAL ENVIRONMENT OF PITCHBLENDE. Leo J. Miller. May 1955. 49p. Contract AT(30-1)-702.

A study was made of the hydrothermal alteration which accompanies primary U deposits. The investigation covered the primary U minerals and their associates, the accompanying wall rock alteration, the processes of U emplacement and the interpretation of the significance of field and laboratory data in terms of U exploration. (J.E.D.)

151   TEI-336A
Geological Survey.
RECONNAISSANCE DURING 1952 FOR URANIUM-BEARING
CARBONACEOUS ROCKS IN PARTS OF COLORADO,
UTAH, IDAHO, AND WYOMING. James D. Vine and
Robert F. Flege, Jr. June 1953. 19p.

A reconnaissance for uranium-bearing carbonaceous
rocks was made in 23 areas in Colorado, Utah, Idaho, and
Wyoming. Uranium in small amounts occurs in several of
the areas examined, but no deposits were found that might
have commercial possibilities. As much as 0.03% uranium
is in the ash of coal in the Caribou Mountain area in south-
eastern Idaho; 0.012% in the ash of coal in the Burnt Fork
area of southwestern Wyoming; and 0.009% in the ash of
coal from near Driggs in eastern Idaho. Seven additional
areas were examined in which beds of coal or carbonaceous
shale contained more than 0.002 but less than 0.007%
uranium in the ash. Unweathered samples of bituminous
sandstone from the Vernal area, Utah, contain minor
quantities of uranium. (auth)

152   TEI-479
Geological Survey.
RADIOACTIVITY OF PART OF THE BITUMINOUS COAL
REGION OF PENNSYLVANIA. E. D. Patterson. Nov. 1954.
44p.

Samples of the commercially important coal beds and
associated rocks in the Pottsville, Allegheny, and
Monongahela series of the Pennsylvanian system were
collected from 104 localities in western Pennsylvania. The
coal and associated rocks examined and sampled at 103
places are nearly nonradioactive and are interpreted to con-
tain essentially no uranium. Radioactive coal was found at
only one locality in Clearfield County where the upper 0.4 ft
of the Lower Freeport coal bed (3.2 ft thick) contains an
average of 0.019% uranium. (auth)

153   TEM-917
Geological Survey.
RECONNAISSANCE EXAMINATION OF THE URANIUM
DEPOSITS NORTHEAST OF WINSTON, BROADWATER
COUNTY, MONTANA. George E. Becraft. Apr. 1955. 10p.

Anomalous radioactivity and a yellow secondary uranium
mineral tentatively identified as carnotite have been found
in Tertiary sedimentary rocks about 3 miles northeast of
Winston, Mont. The uranium is in tuffs and tuffaceous
shales and particularly in beds rich in organic matter.
Carnotite(?) was identified from three localities, princi-
pally coating fractures but in places partly replacing
organic material, and anomalous radioactivity without
recognizable uranium minerals has been detected at four
localities. Six of the seven localities are at approximately
the same stratigraphic horizon. The deposits are virtually
unexplored and consequently their size and grade are not
known. Selected specimens assay as high as 0.36% eU.
Exploitable deposits of uranium may be found in this area,
as well as in similar areas of western Montana that are
underlain by Tertiary tuffaceous rocks. (auth)

154
GEOLOGY OF THE GYPSUM GAP QUADRANGLE,
COLORADO. GEOLOGIC QUADRANGLE MAP GQ-59.
Fred W. Cater, Jr. Washington, U. S. Geological Survey,
1955.

The Gypsum Gap, Calamity Mesa, Joe Davis Hill, Hamm
Canyon, and Egnar quadrangles are 5 of 18 7$\frac{1}{2}$' quadrangles
covering the principal carnotite-producing area of south-

western Colo. The rocks exposed in the eighteen quadran-
gles consist of crystalline rocks of pre-Cambrian age and
sedimentary rocks that range in age from late Paleozoic to
Quaternary. Over much of the area the sedimentary rocks
are flat lying, but in places the rocks are disrupted by high-
angle faults, and northwest-trending folds. Conspicuous
among the folds are large anticlines having cores of intru-
sive salt and gypsum. Most of the carnotite deposits are
confined to the Salt Wash sandstone member of the Jurassic
Morrison formation. Within this sandstone, most of the
deposits are spottily distributed through an arcuate zone
known as the "Uravan Mineral Belt". Individual deposits
range in size from irregular masses containing only a few
tons of ore to large, tabular masses containing many
thousands of tons. The ore consists largely of sandstone
selectively impregnated and in part replaced by U and V
minerals. Most of the deposits appear to be related to
certain sedimentary structures in sandstones of favorable
composition. (auth)

155
GEOLOGY OF THE HAMM CANYON QUADRANGLE,
COLORADO. GEOLOGIC QUADRANGLE MAP GQ-69.
Fred W. Cater, Jr. Washington, U. S. Geological Survey,
1955.

(See abstract above)

156
GEOLOGY OF THE JOE DAVIS HILL QUADRANGLE,
COLORADO. GEOLOGIC QUADRANGLE MAP GQ-66.
Fred W. Cater, Jr. Washington, U. S. Geological Survey,
1955.

(See abstract above)

157
GEOLOGY OF THE CALAMITY MESA QUADRANGLE,
COLORADO. GEOLOGIC QUADRANGLE MAP GQ-61.
Fred W. Cater, Jr. Washington, U. S. Geological Survey,
1955.

(See abstract above)

158
GEOLOGY OF THE EGNAR QUADRANGLE, COLORADO.
GEOLOGIC QUADRANGLE MAP GQ-68. Fred W. Cater,
Jr. Washington, U. S. Geological Survey, 1955.

(See abstract above)

159
GEOLOGY OF THE RED CANYON QUADRANGLE,
COLORADO. GEOLOGIC QUADRANGLE MAP GQ-58.
E. J. McKay. Washington, U. S. Geological Survey, 1955.

A study covering the principal examination of mines and
geologic mapping of eighteen 7$\frac{1}{2}$-minute quadrangles of the
Red Canyon Quadrangle was made. Many small mines and
prospects are scattered along the outcrop of the lowest
sandstone stratum of the Salt Wash. The deposits are small
and consist of thin streaks of relatively high-grade ore.
These deposits contain copper carbonate stain whereas
deposits in the upper sandstone stratum rarely contain any
visible copper minerals. The only commercial important
mineral deposits in the Red Canyon quadrangle are those
containing U, V, and Ra. (J.E.D.)

160
GEOLOGY OF THE HAPPY JACK MINE, WHITE CANYON
AREA, SAN JUAN COUNTY, UTAH. Albert F. Trites, Jr.
and Randall T. Chew, III. U. S. Geol. Survey Bull. 1009-H,
1955. 17p. plus 2 illus. $0.40 (GPO).

The Happy Jack mine is in the White Canyon area, San

Juan Co., Utah. Production is from high-grade uranium deposits in the Shinarump conglomerate of Triassic age. The Shinarump strata range from $16\frac{1}{2}$ to 40 ft in thickness and the lower part of these beds fills an eastward-trending channel that is more than 750 ft wide and 10 ft deep. The Shinarump conglomerate consists of beds of coarse- to fine-grained quartzose sandstone, conglomerate, siltstone, and claystone. Carbonized wood is abundant in these beds, and in the field it was classified as mineral charcoal and coal. Uranium occurs as bedded deposits, as replacement bodies in accumulations of "trash," and as replacements of larger fragments of wood. An "ore shoot" is formed where the three types of uranium deposits occur together; these ore shoots appear to be elongate masses with sharp boundaries. Uranium minerals include uraninite, sooty pitchblende (?), and the sulfates—betazippeite, johannite, and uranopilite. Associated with the uraninite are the sulfide minerals covellite, bornite, chalcopyrite, and pyrite. Galena and sphalerite have been found in close association with uranium minerals. The amount of uranium minerals deposited in a sandstone bed is believed to have been determined by the position of the bed in the channel, the permeability of the sandstone in the bed, and the amount of carbonized wood and plant remains within the bed. Not all of these features can be demonstrated in the Happy Jack mine itself. The beds considered most favorable for uranium deposition contain an abundance of claystone and siltstone both as matrix filling and as fragments. (auth)

161

GEOLOGIC AND AIRBORNE RADIOACTIVITY STUDIES IN THE ROCK CORRAL AREA, SAN BERNARDINO COUNTY, CALIFORNIA. R. M. Moxham, G. W. Walker, and L. H. Baumgardner. U. S. Geol. Survey Bull. 1021-C, 1955. 20p. plus 2 illus. (GPO)

The investigation in the Rock Corral area was undertaken to determine the relation between the anomalously high radioactivity recorded during an airborne survey and the distribution and mode of occurrence of radioactive material. Thorium-bearing minerals occur in relatively small, highly radioactive biotite-rich inclusions in a porphyritic quartz monzonite. Radioactive accessory minerals are also disseminated in the porphyritic quartz monzonite and in detritus derived from the porphyritic quartz monzonite. The configuration and amplitude of the major radioactivity anomalies detected from the air indicate that they have resulted chiefly from the large masses of porphyritic quartz monzonite rather than the biotite-rich inclusions. An analysis of the recorded radioactivity anomalies in the Rock Corral area and the equivalent-uranium content of the source rocks indicates that the lower limit of sensitivity of the airborne equipment, with respect to gross geologic features, is probably 0.001%. (auth)

162

PHOTOGEOLOGIC MAP OF THE ANETH-1 QUADRANGLE, SAN JUAN COUNTY, UTAH, AND MONTEZUMA COUNTY, COLORADO. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-90. R. J. Hackman. Washington, U. S. Geological Survey, 1955. $0.50.

163

PHOTOGEOLOGIC MAP OF THE ANETH-3 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-92. R. J. Hackman. Washington, U. S. Geological Survey, 1955. $0.50.

164

PHOTOGEOLOGIC MAP OF THE ANETH-6 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-95. R. J. Hackman. Washington, U. S. Geological Survey, 1955. $0.55.

165

PHOTOGEOLOGIC MAP OF THE ANETH-7 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-96. R. J. Hackman. Washington, U. S. Geological Survey, 1955. $0.50.

166

PHOTOGEOLOGIC MAP OF THE ANETH-8 QUADRANGLE, SAN JUAN COUNTY, UTAH, AND MONTEZUMA COUNTY, COLORADO. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-97. R. J. Hackman. Washington, U. S. Geological Survey, 1955. $0.50.

167

PHOTOGEOLOGIC MAP OF THE ELK RIDGE-6 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-98. J. S. Detterman and J. C. Reed, Jr. Washington, U. S. Geological Survey, 1955. $0.50.

168

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-1 QUADRANGLE, EMERY AND CARBON COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-99. J. S. Detterman. Washington, U. S. Geological Survey, 1955. $0.50.

169

PHOTOGEOLOGIC MAP OF THE DESERT LAKE-2 QUADRANGLE, EMERY AND CARBON COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-100. C. F. Miller. Washington, U. S. Geological Survey, 1955. $0.50.

170

OCCURRENCE OF TECHNETIUM-98 IN NATURE. Edward A. Alperovitch and J. M. Miller (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). Nature 176, 299-301(1955) Aug. 13.

Results of a neutron-activation determination of Tc^{98} in minerals are presented. Separation of the Tc^{98} from the chief interfering elements, Mo^{98} and Ru^{99}, is achieved by a combination of anion-exchange, chromatographic, and distillation techniques. (C.W.H.)

171

URANIUM DEPOSITS IN SOUTH AUSTRALIA. S. B. Dickinson, R. C. Sprigg, D. King, M. L. Wade, B. P. Webb, A. W. G. Whittle, F. L. Stillwell, and A. B. Edwards. Australia(South) Geol. Survey Bull. No. 30, 1954. 151p. plus 2 illus.

A general report of the known occurrences of radioactive minerals in South Australia is presented. The principal districts surveyed were Radium Hill Area, Crockers Well Deposit, Mount Painter, Houghton, and Kersbrook Areas and Olary Districts. (auth)

METALS AND METALLURGY

172   AD-43730

New York Univ., New York. Coll. of Engineering. THE TITANIUM—VANADIUM—IRON AND TITANIUM—ALUMINUM—IRON SYSTEMS. Final Report. L. Stone

and H. Margolin. [1954?]. 72p. Contract NOa(s)-53-021-C.

Using commercially pure titanium, the ternary systems titanium−vanadium−iron and titanium−aluminum−iron have been delineated. The Ti−V−Fe system was investigated in a composition range from zero to 25% V and from 0 to 45% Fe and in a temperature range from 700 to 1000°C and solidus state. The Ti−Al−Fe system was investigated in a composition range from less than 100% alloying addition to less than 45% alloying addition and in temperature ranges from 850 to 1100°C and 900 to 1100°C. The Ti−V−Fe−system contains a ternary compound at approximately 14% vanadium and 31% iron. The extensive beta fields in the binary systems are limited in the ternary systems by the presence of this compound. The Ti−Al−Fe system appears to be quite complex, with one ternary compound clearly established and evidence for either one or two additional ternary compounds. At 900°C, the beta field is strongly restricted, although with increasing temperature this phase shows increasing solubility for aluminum. The alpha phase is restricted at all temperatures investigated. At and above 1000°C, the alpha-plus-beta phase field is extensive. (auth)

173 AECU-3096

Knolls Atomic Power Lab., Schenectady, N. Y.
SEALING RADIOACTIVE SPECIMENS IN GLASS AMPOULES. Myron B. Reynolds. [1955?]. 3p. Contract W-31-109-Eng-52.

The handling, sealing in glass ampoules, and storage of specimens of neutron-irradiated metal wire is described. (C.H.)

174 ATI-52341

National Bureau of Standards, Washington, D. C.
EFFECT OF WELDING ON THE STABILIZATION OF 18% Cr−8% Ni CORROSION-RESISTING STEEL. (TED No. NBS-2562). Report No. 11. Samuel J. Rosenberg. Nov. 16, 1948. 13p.

175 BM-RI-5141

Bureau of Mines.
TITANIUM PLANT AT BOULDER CITY, NEV.: ITS DESIGN AND OPERATION. C. T. Baroch, T. B. Kaczmarek, W. D. Barnes, L. W. Galloway, W. M. Mark, and G. A. Lee. Jan. 1955. 78p.

The design features and techniques used in operating a plant capable of producing about 1,500 lb of titanium metal per day are reported. The process used was based on the reduction of titanium tetrachloride with magnesium, a modification of what is generally known and spoken of as the Kroll process. Sponge metal crushed to melter's specifications was the end product of the operation as conducted. The report is divided into sections covering general plant layout and the major unit operations. These, in turn, are each divided into discussions of the equipment, operating procedures, and typical results. An attempt was made to emphasize the more important pitfalls likely to be encountered and to discuss the alternative procedures used in over 2 years of continuous operation, during which over one-half million pounds of titanium sponge metal was produced. (auth)

176 BMI-1037

Battelle Memorial Inst., Columbus, Ohio.
FABRICATION AND WELDING OF ARC-CAST MOLYBDENUM. Norman E. Weare, Robert E. Monroe, and George W. Rengstorff. Sept. 6, 1955. 48p. Contract W-7405-eng-92.

The development of improved materials and procedures for producing molybdenum weldments with good room-temperature ductility was investigated. Sheet materials and fusion weldments made in a dry box from $\frac{1}{16}$- and $\frac{1}{8}$-in.-thick arc-cast molybdenum had good bend properties at low temperatures. The best ductility was obtained from 0.7 wt.% titanium-neutralized molybdenum and carbon-deoxidized molybdenum with a low carbon content (>0.025 wt.%). The effects of variations in composition, preparation of ingots, and fabrication procedures on ductility were studied on both types of material. The 0.7 wt.% titanium alloy had better bend ductility than 0.5 and 1.0 wt.% titanium alloys. Simplified melting and fabrication procedures did not adversely affect the ductility of titanium-neutralized molybdenum, although double melting of the ingots was required to avoid weld porosity. Better weld ductility was obtained from lower carbon content material in commercial carbon-deoxidized molybdenum. However, the ductility of sheet and weldments in experimentally rolled carbon-deoxidized molybdenum was not affected by the carbon content. Rolling in a protective jacket did not affect the ductility in either type of molybdenum. An over-all improvement in weldment ductility was obtained by welding in a high-purity helium atmosphere and grinding the weld surface after welding. (auth)

177 MAB-101-M

National Research Council. Materials Advisory Board.
COLUMBIUM−TANTALUM. Oct. 21, 1955. 20p. Contract DA-49-025-sc-83.

Data are summarized on the availability and applications of Nb and Ta. Restrictions on the use of the metals are reviewed, and data are presented on the production, present usage, and probable consumption and uses of these metals when restrictions are removed. (C.H.)

178 NP-5781

California Inst. of Tech., Pasadena. Dynamic Properties Lab.
A FURTHER INVESTIGATION OF DYNAMIC STRESS-STRAIN RELATIONS FOR ANNEALED 2S ALUMINUM UNDER COMPRESSION IMPACT. K. R. King, D. S. Wood, and D. S. Clark. July 1955. 28p. Project NR 031-285. Contract N6onr-24418, Technical Report 11.

The behavior of annealed 2S aluminum when subjected to compression impact was studied. The presence of a dynamic stress-strain relation lying above the static curve was indicated. It was suggested that this dynamic stress-strain relation varies with impact velocity, and thus with the maximum stress obtained. Measurements involving only the maximum stress and strain attained at one point in the test of a given specimen were made. The dynamic stress-strain relation was calculated by means of the theory of plastic wave propagation, neglecting strain rate effects, from measurements of stress as a function of time at the impact end of the specimen, and strain as a function of time at a position several inches from the impact end. This method allows the determination of a complete stress-strain curve from the test of a single specimen. Thus this method, together with a strain measuring technique of higher sensitivity, has made it possible to observe more closely the behavior of 2S aluminum in the range of strains up to 3×10^{-3} in./in. The results of the present experiments give further support to the conclusions regarding the

presence of an elevated dynamic stress-strain relation and disclose in more detail the behavior of aluminum when subjected to impact loading. The amount by which the dynamic curve is displaced above the static curve is nearly constant over the range of strains investigated. Thus the difference arises primarily from an increase in the elastic limit under impact loading. A slight reduction in the maximum strain amplitude with distance along the specimen was observed. This indicates that the dynamic stress-strain relation depends to a small degree upon time or strain rate, under the test conditions employed. This conclusion was based upon the difference between the observed final value of maximum strain and the calculated value given by the plastic wave propagation theory, rather than upon a reduction in maximum strain with distance along the specimen. (auth)

179 NP-5783

Metallurgical Advisory Committee on Titanium. STATUS BULLETIN NO. P16 ON UNCLASSIFIED TITANIUM RESEARCH AND DEVELOPMENT OF ARMY ORDNANCE CORPS. Feb. 1955. 50p.

The results of cooperative studies on the preparation, metallurgy, and chemistry of Ti and Ti alloys are outlined. (For preceding period see NP-5535.) (C.W.H.)

180 NP-5789

Illinois Inst. of Tech., Chicago. Armour Research Foundation. EFFECTS OF VIBRATION DURING SOLIDIFICATION OF CASTINGS. Final Report [for] July 1, 1951 to June 30, 1952. W. Rostoker, Morris J. Berger, and Gordon W. Johnson. 43p. Project No. 90-1059-B. Contract DA-11-022-ORD-355.

It has been demonstrated that considerable grain refinement can be effected in Al−Cu alloys by the imposition of vibrations during solidification. The effects of solidification rate, alloy content, and vibrational intensity on the comparative grain refinement have been studied. Additional structural effects relating to columnar grain growth, eutectic segregation, and chemical segregation have been noted. (auth)

181 NP-5790

Lehigh Univ., Bethlehem, Penna. Inst. of Research. THE THERMAL AND ELECTRICAL CONDUCTIVITIES OF LEAD−BISMUTH ALLOYS. Technical Report No. 3 [on] THE INVESTIGATION OF THERMAL AND ELECTRICAL CONDUCTIVITIES OF METALS AT HIGH TEMPERATURES. Joseph M. Clifford. June 15, 1955. 81p. DA Project No. 599-01-004. Contract DA-36-034-ORD-1475.

Mathematical analysis of the Forbes-bar method for measuring thermal conductivity of metals is studied. Measurements were made of the thermal conductivity and electrical resistivity of a series of Bi specimens containing small amounts of Pb. (auth)

182 NRL-4545

Naval Research Lab., Washington, D. C. EFFECT OF TEMPERATURE ON THE DUCTILITY OF HIGH-STRENGTH STRUCTURAL STEELS LOADED IN THE PRESENCE OF SHARP CRACKS. P. P. Puzak and W. S. Pellini. May 6, 1955. 31p.

The effect of temperature on the fracture characteristics of various high-strength structural steels when loaded in the presence of a sharp, crack-like notch, was determined

by the NRL Drop-Weight and Explosion Crack-Starter Tests. The test procedures establish three critical transition temperatures related to the specific loading conditions required to initiate and propagate brittle fractures. As the temperature is lowered, all of the steels are shown to pass from (1) a completely ductile state such that only shear tearing is possible even under conditions of severe plastic deformation; to (2) a range of temperatures wherein brittle fractures are initiated only after relatively large plastic deformation and propagate only in the deformed regions; to (3) a lower range of temperatures wherein propagation occurs through elastic-loaded material, but initiation is difficult to the extent that appreciable plastic deformation is required; and finally to (4) a temperature below which initiation occurs at the yield point, i.e., in the absence of deformation (% elongation equals zero). The temperature interval of change from the state of complete ductility to nil ductility is shown to be a 100° ± 20°F for all of the steels investigated. This interval was determined to be in the −200 to −100°F temperature range for the steel of highest notch ductility and in the +100 to +200°F range for the steel of lowest notch ductility. The concept of critical fracture transition temperatures is advanced to define the changes of the steels with respect to absolute temperature levels of the transition interval. A discussion is presented relative to the use of the critical transition temperature concept in design. (auth)

183 NYO-7048

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy. SOLID SOLUTIONS AND GRAIN BOUNDARIES. Progress Report No. 26. B. L. Averbach, M. Cohen, F. Herbstein, J. Hilliard, and R. Kaplow. June 30, 1955. 5p. Contract AT(30-1)-1002, Scope II.

Studies were continued on the fundamental behavior of solid solutions using thermodynamic and x-ray techniques. (For preceding period see NYO-7044.) (C.W.H.)

184 NYO-7075

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy. FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION. Progress Report No. 19. B. L. Averbach, M. Cohen, S. Allen, M. F. Comerford, and C. Houska. June 30, 1955. 4p. Contract AT(30-1)-1002, Scope III.

Progress is reported in studies on plastic deformation in metals and of changes which occur on annealing. Data are included from an x ray study of recovery, recrystallization, and effects of annealing on Au−Ag alloy; recovery and recrystallization in α brass; and imperfections in transformed Co. (C.H.)

185 PIBAL-252

Brooklyn. Polytechnic Inst. CREEP BUCKLING. N. J. Hoff. May 1954. 26p. Contract AF 33(616)-116. (AD-41213)

A theory of creep buckling is presented in which the instantaneous elastic and plastic deformations following the application of a load as well as the steady creep deformations are considered in an approximate manner. Equations are given from which the critical time, that is, the time elapsing between load application and the collapse of the column, can be computed. (See also AD-41212.) (auth)

186   PIBAL-254
Brooklyn. Polytechnic Inst.
RAPID CREEP IN STRUCTURES. N. J. Hoff. May 1954.
52p. Contract AF33(616)-116. (AD-41212)

A survey of the effects of rapid creep upon the stress
distribution in structures and of the various modes of creep
failure is presented. It is proposed that rapid creep should
be tolerated when aerodynamic heating causes high tem-
peratures for only a short time in structural elements of
supersonic aircraft. (auth)

187   S and T Memo-8/54
Production Engineering Research Assn. of Great Britain,
    Melton Mowbray, Leics., England.
DRILLING TITANIUM ALLOY Ti 150A. July 1954. 27p.
Agreement 7/Experimental/674/R.3. (AD-39372)

188   SO-2523
General Electric Co. Research Lab., Schenectady, N. Y.
DEVELOPMENT OF ZIRCONIUM-BASE ALLOYS. Twenty-
third Quarterly Report. (Progress Report No. 24). J. H.
Keeler. July 5, 1955. 24p. Contract W-31-109-Eng-52.
(55-RL-1405)

The short-time tensile properties of zirconium—
aluminum, zirconium—silicon and zirconium—aluminum—
silicon alloys are given for the temperature range −195°
to 500°C. The initial incremental strengthening of zirco-
nium and by silicon is much greater than later incremental
amounts. The strengthening effects of the individual alloy-
ing elements silicon and aluminum are not additive when
the elements are added simultaneously to zirconium. Small
additions of silicon or aluminum are among the most
potent strengtheners of the alloying elements examined in
this program. However, subsequent additions of these two
elements are not very effective in their strengthening.
The tensile characteristics of beta-annealed iodide process
zirconium are given for the temperature range −195 to
500°C. The tensile properties of chloride process zirco-
nium as a function of temperature and orientation in rela-
tion to rolling direction are reported. Stress-rupture
time and stress-minimum creep-rate curves for binary
alloys at room temperature and at 500°C are given. (auth)

189   TML-15
Battelle Memorial Inst. Titanium Metallurgical Lab.,
    Columbus, Ohio.
THE ENGINEERING PROPERTIES OF COMMERCIAL
TITANIUM ALLOYS. M. W. Mote, Jr. and P. D. Frost.
Sept. 22, 1955. 85p.

The general composition and designation of Ti alloys
made in commercial ingot size, properties of the commer-
cial alloys of Ti in annealed and heat-treated conditions,
and a review of data on the uniformity of the alloys are
discussed. Information for designers and users of air-
craft structural materials as applied to Ti is given. (auth)

190   WADC-TR-53-4(Suppl.1)
Illinois Inst. of Tech., Chicago. Armour Research
    Foundation.
CONSTITUTION OF TITANIUM ALLOY SYSTEMS.
Supplement 1. [Period Covered February 1953 to
September 1954.] David W. Levinson, Donald J.
McPherson, and William Rostoker. Sept. 1954. 15p.
Project No. 7351. Contract AF33(616)-2559.

This report is a supplement to WADC TR 53-41 on the
Constitution of Titanium Alloy Systems. The new informa-
tion available in the period February 1953 to September

1954 relating to binary and ternary systems, including
crystal structures, is compiled and critically evaluated.
An effort has been made to standardize the presentations
from sources, both published and unpublished, in every
way possible for ease of comparison of all systems and for
ease of abstraction of specific required information. (auth)

191   WADC-TR-53-477
Wyandotte Chemical Corp., Wyandotte, Mich.
SURFACE TREATMENT OF METALS FOR ADHESIVE
BONDING. [Final Summary Report]. Robert S. Shane,
Theodore L. Eriksson, Alexander Korczak, and Dwight B.
Conklin. Sept. 1954. 102p. Contract AF 33(616)-2055.
(AD-49021)

Preliminary studies were made on the preparation of
aluminum, stainless steel, and magnesium surfaces for
adhesive bonding. The lap joint shear test at room tem-
perature was used as the criterion. Tests on samples ex-
posed to 95% relative humidity for 14 days and salt spray
for 30 days are also included. A Dillon Universal Tester,
as modified to provide motorization, pacing, and improved
grips, is detailed. Bloomingdale FM-47 adhesive was used
as the screening adhesive; other adhesives evaluated were
Scotchweld No. 585 Tape, Shell Epon VIII adhesive, and
Metlbond MN 3C tape. Eight other adhesives were ex-
amined in making a choice of screening adhesive. Approxi-
mately twenty different etchants were tried for stainless
steel; a surface treatment is recommended as giving bond
strengths substantially the same as those produced on
aluminum using a modified Forest Products Laboratory
surface treatment. In preliminary work on magnesium
surfaces, eighteen etchant formulations were examined.
Surface treatments AD and AE show mean shear strengths
in excess of 2300 psi at room temperature without zinc
chromate lacquer primer. A method for distinguishing
between adhesive and cohesive failure is described. (auth)

192   WADC-TR-55-111
General Electric Co. Research Lab., Schenectady, N. Y.
TENSILE DEFORMATION OF MOLYBDENUM AS A
FUNCTION OF TEMPERATURE AND STRAIN RATE. R.
P. Carreker, Jr. and R. W. Guard. Jan. 1955. 30p.
Project 7351. Contract AF33(616)-2120.

True stress-true strain data are reported for nominally
pure molybdenum (99.95%) over the temperature range
from −196° to 1540°C (0.027 to 0.63 T/T_m). Strain-rate
sensitivity was determined by rate-change tests and stress-
relaxation tests. Inhomogeneous yielding and strain-aging
effects were observed. The yield stress and tensile
strength depend markedly on temperature below 400°C and
are insensitive to temperature in the range 400 to 800°C.
The ductile-to-brittle transition range is +25° to −25°C.
Strain-rate sensitivity and stress-relaxation effects are
very large near room temperature. (auth)

193   WAL-401/227
Wyandotte Chemicals Corp., Wyandotte, Mich.
INVESTIGATION OF THE ELECTRODEPOSITION OF
HARD NICKEL AND HARD CHROMIUM PLATES ON
TITANIUM AND TITANIUM ALLOYS. Final Summary
Report [Covering the Period July 1, 1954 to June 30, 1955].
Elaine J. Rosenbaum and Wayne G. Lajiness. June 30,
1955. 125p. W. C. C. Project No. 622; D/A Project 593-
08-021. Contract DAI-20-018-.505-ORD-(P)-22.

The objective of this project was to produce hard nickel
and hard chromium plates on titanium and titanium alloys.
Adherent nickel electroplates could not be obtained on

titanium specimens which were cleaned by scraping, by polishing or blasting with abrasive, or by etching in acid. Attempts to throw adherent nickel plates over immersion deposits or electroplates struck on titanium specimens from acid copper, nickel, zinc, cadmium, manganese, and iron salt solutions were unsuccessful. Basic zinc plating baths and zinc chloride solutions in acetone and alcohol were tested, but failed to yield satisfactory plates on titanium. Chemical plates deposited from "electroless" nickel baths, containing either sodium hypophosphite or hydrazine as the reducing agent, were also non-adherent. Mixtures of hydrofluoric acid and non-ionic surfactants, anionic surfactants, amine salts, or perfluorinated carboxylic acids were tested as preplating baths. Several largely non-aqueous preplating solutions darkened the titanium at low hydrogen fluoride concentrations. The nickel plate struck over the dark surface showed improved adherence, but the plate could be detached after repeated flexing. Plating tests were performed with titanium cathodes in two chromic acid plating baths and in selected complex nickel solutions. Adherent plates were not obtained. A few plating tests were also performed on specimens of titanium alloy RC-130B. The results were similar to those obtained by plating on Ti-75A metal. (auth)

194   WAL-401/237
Watertown Arsenal Lab., Mass.
EVALUATION OF A MOLYBDENUM BORIDE CUTTING TOOL IN TURNING TITANIUM ALLOY Ti 150A. Eugene DiCesare. June 9, 1955. 22p. DA Project 593-08-021.

A molybdenum-nickel boride cutting tool material, identified as K boride, has been evaluated as a single point lathe turning tool for machining titanium alloy Ti-150A. Machinability tests and a metallurgical examination of K boride and two grades of cemented tungsten carbides bonded with cobalt were conducted and the results compared. The cutting speed range for an equivalent tool life of the K boride was found to be better than that of a tungsten carbide grade comparable in hardness and structural coarseness, but poorer than that of the grade found to be optimum for machining titanium. A metallurgical examination of the K boride suggests that improvement of the microstructure would increase its value as a cutting tool. (auth)

195   WAPD-TN-521
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
EVALUATION OF HAFNIUM CRYSTAL BAR. R. B. Stermon. Aug. 1955. 32p.

An investigation was made to determine whether or not hafnium crystal bar, which appeared to be of questionable quality based on corrosion tests of "hairpins" could safely be used for the fabrication of control rod stock. A statistical experiment of Graeco-Latin Square design was employed for the solution to this problem. Considerable data on chemical and mechanical properties of hafnium rolled stock made from accepted and questionable quality crystal bar were derived. Significant conclusions to be drawn from this work are the questionable material in the "Bad" category is comparable with "Good" crystal bar with respect to corrosion and mechanical properties when processed under conditions specified herein and the "Very Bad" material, although corrosion resistant, is unusable because of inferior mechanical properties. There are indications that this "Very Bad" material might be diluted with "Good" crystal bar to render acceptable stock. Rec-

ommendation is made to further explore this possibility. (auth)

196   AERE-Lib/Trans-563
THE BEHAVIOUR OF COMPACTED BINARY MIXTURES OF GOLD AND SILVER POWDERS ON SINTERING WITH OTHER METALLIC POWDERS. Ernest Raub and Werner Plate. Translated by F. Hudswell from Z. Metallkunde 40, 206-14(1949). 19p.

The behavior on sintering is investigated for a large number of binary mixtures of gold and silver powders with other metallic powders which were pressed at 7000 kg/cm^2. The course of the linear thermal expansion and the specific resistance of the pressings, plotted against the temperature of sintering, shows no characteristic deviations from those of pressings of the pure metals when there are no reactions between the two metals. The properties of the pressings of binary mixtures can be deduced simply from those of the pure metals on sintering. The formation of mixed crystals or intermediate phases is expressed in the linear thermal expansion in a more or less strongly marked sudden addition to the expansion as a result of the occurrence of diffusion porosity. A slight reaction on sintering in which mixed crystals are formed is not clearly distinguished in some circumstances in the plot of the linear expansion. The measurement of the specific resistance responds to this with more sensitivity. (auth)

197   NRL-Trans-456
SUPERCONDUCTIVITY OF ALLOYS OF BISMUTH WITH RUBIDIUM AND CESIUM. (Sverkhprovodimost' Splavov Bismuta s Rubidiem i Tseziem). N. E. Alekseevski[i]. Translated by J. K. Logan from Zhur. Eksptl'. i Teoret. Fiz. 23, 610(1952). 2p.

198
ZIRCONIUM: FABRICATION TECHNIQUES AND ALLOY DEVELOPMENT. C. E. Lacy and J. H. Keeler (General Electric Co., Schenectady, N. Y.). Mech. Eng. 77, 875-8 (1955) Oct.

The fabrication techniques by which zirconium and its alloys have been made successfully into various product forms are described. The neutron-absorption characteristics, mechanical properties, and corrosion resistance of zirconium and some zirconium alloys are discussed. (auth)

199
MELTING PROCESS OFFERS HIGHER QUALITY SUPER-ALLOYS. W. W. Dyrkacz (Allegheny Ludlum Steel Corp., Watervliet, N. Y.). Iron Age 176, No. 17, 75-7(1955) Oct. 27.

A new development in melting superalloys marks another advance in the fast-growing field of vacuum metallurgy. These highly important materials are arc melted under vacuum, using consumable electrodes. Results obtained for the method include: ingots up to 2000 lb, improved metal cleanliness, lower gas content and close control of solidification rates. The promise showed by the process justifies plans to produce 5000-lb ingots in the near future. (auth)

PHYSICS

200   AECU-3093
Los Alamos Scientific Lab., N. Mex.
THE ADSORPTION OF He^3 AND He^4 ON ACTIVATED CHARCOAL. C. J. Hoffman, F. J. Edeskuty, and E. F.

Hammel. [1955]. 23p. Contract [W-7405-eng-36].

The adsorption of pure He^3 on activated charcoal at 2.5 and 3°K, and of pure He^4 at 4°K has been measured. The volume of gas necessary to form a monolayer is approximately the same for the two isotopes. It is shown that capillary condensation does not occur in this adsorbent at low saturations. The data have been analyzed by a number of methods with consistent results. (auth)

201   CERN-55-18
European Organization for Nuclear Research, Geneva.
A CONTRIBUTION TO THE STUDY OF NUCLEAR MAGNETISM; THREE STUDIES. Félix Bloch, James T. Arnold, and Weston A. Anderson. Sept. 1, 1955. 232p.

Three studies of nuclear magnetism are presented: the dynamical theory of nuclear induction, the magnetic resonances of protons in ethyl alcohol, and nuclear magnetic resonance spectra of some hydrocarbons. Resonance effects of weak and strong fields on weak and strong couplings, and of strong alternating fields on weak couplings are discussed. Application of the Boltzmann equation to the quantitative derivation of these effects is shown. The Hamiltonian description of the behavior of the spin system in ethyl alcohol under strong magnetic influence is given, and applications to the determination of resonance spectra for more complex hydrocarbons are made. (D.E.B.)

202   CRCE-608
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
HEAVY WATER PRODUCTION BY NATURAL WATER DISTILLATION. III. WETTED-WALL COLUMN DEVELOPMENT. A. R. Bancroft and H. K. Rae. July 1955. 58p. (AECL-230).

The development of a wetted-wall type of packing which would be suitable for heavy water production by natural water distillation is described. A series of parallel vertical aluminum sheets has been found to be the most satisfactory type. The sheets were fabricated in structurally strong units which would be suitable for packing a large distillation column. Test results for a 4-ft air-water column are given. (auth)

203   NP-5778
Midwest Research Inst., Kansas City, Mo.
SURVEY OF THE NATURE OF THE FRICTION FORCES IN MOLYBDENUM DISULPHIDE LUBRICATION. Final Report. V. R. Johnson. Oct. 10, 1955. 56p. MRI Project No. 129-P-65; DA Project No. 599-01-004. Contract DA-23-072-ORD-768.

The present program was undertaken to investigate the nature of the forces acting when molybdenum disulfide, a laminar solid, is used as a lubricant between bearing surfaces. The investigation was prompted in part by the apparently inconsistent behavior between graphite and MoS_2. Both of these are layer-lattice crystals and would generally be expected to exhibit similar lubricating behavior. Prior work had shown that in vacuum graphite does not lubricate effectively, while MoS_2 is an excellent vacuum lubricant. The results indicate that the behavior of graphite and MoS_2 is basically consistent. For graphite, as previously shown, vapor adsorbed onto the surface is required for lubrication. If this layer is removed in vacuum, high friction and wear results. The present experiments indicate that an adsorbed sulfur layer is responsible for

the vacuum lubrication of the MoS_2 crystal. Thus, an adsorbed layer provides the lubricating mechanism in both crystals. The layer-lattice structure provides a surface of low-bonding energy for the adsorption. (auth)

204   AEC-tr-2293
ELECTRODYNAMICS OF A GYROTROPIC MEDIUM. A. A. Kolomenskiĭ. Translated from Zhur. Eksptl'. i Teoret. Fiz. 24, 167-76(1953). 12p. Available from Associated Technical Services (Trans. 59G6R), East Orange, N. J.

Formulas are obtained for the energy radiated and for the radiation field of charges moving in a gyrotropic medium. These formulas are applied to the case of radiation from an oscillator and to the case of radiation from an electron moving with a constant velocity in a given medium (Cherenkov effect). (auth)

205   AERE-Lib/Trans-443
THE OCCURRENCE OF MAGNETIC FIELDS IN LIQUID CIRCULATING MERCURY. F. Burhorn, H. Griem, and W. Lochte-Holtgreven. Translated by E. R. Hollely from Z. Physik 137, 175-89(1954). 13p.

A toroidal circulation of mercury is maintained in a cylindrical vessel. With this flow the ions have, on the average, a different drift velocity to the electrons, so that there occurs an electrical "diffusion" current, the magnetic field of which is measured. In the experimental apparatus used, the magnitude of the magnetic field, with a rotation frequency of 25 cycles/sec is 4.3×10^{-4} Oe. From the direction of the magnetic field it is possible to determine the direction of the diffusion current. Equations for the motions of the electrons and ions are given, from which an estimate of the diffusion current is made. The calculated order of magnitude and the direction of the diffusion current are in agreement with the experimental results. The density of the diffusion current is proportional to the pressure gradient. (auth)

206
LIQUID METALS. PART III. THE INFLUENCE OF OXIDE FILMS ON THE SURFACE TENSION OF LIQUID SODIUM. C. C. Addison, W. E. Addison, and D. H. Kerridge (Univ. of Nottingham, England). J. Chem. Soc., 3047-50(1955) Sept.

The drop-volume technique has been used to determine the changes in surface tension of liquid sodium which occur when dry air is introduced into the argon atmosphere surrounding the metal drops. At 180°C, the surface tension decreases linearly with partial pressure of oxygen, from 194 to 186 dynes/cm. A minimum occurs at an oxygen partial pressure of 2×10^{-4} atm., after which the tension can increase to very high values. The tension minimum is related to the change from a soluble to an insoluble film of sodium oxide at the metal surface. (For preceding report in series see J. Chem. Soc. 2262-4(1955) July.) (auth)

207
GENERAL MOTORS BUILDS RADIOISOTOPE LABORATORY. A. Somerville (General Motors Corp., Detroit). Nucleonics 13, No. 10, 68(1955) Oct.

208
ENERGY LEVELS OF Mu-MESIC ATOMS. S. M. Shah (Physical Research Lab., Ahmedabad, India). Proc. Phys. Soc. (London) A68, 945-6(1955) Oct. 1.

The non-relativistic Schroedinger equation for the model given by Vachaspati for nuclear charge distribution (Phys. Rev. 93, 502(1954)) is applied to the mu-mesic Pb atom to determine the $2P_{1/2} \rightarrow 1S_{1/2}$ transition energy level. (L.M.T.)

209

MEMBRANE SEPARATIONS IN THE LIQUID PHASE.
Karl Kammermeyer and D. H. Hagerbaumer (State Univ. of
Iowa, Iowa City). A.I.Ch.E. Journal 1, 215-19(1955) June.

It has been established that separations in the liquid
phase can be accomplished by straightforward pressure
permeation through microporous membranes. The re-
ported results indicate what may be expected of such a
process. Industrial applications will largely depend on the
rates of permeation which can ultimately be obtained. While
the process suffers from the basic disadvantage of all
membrane processes, that is, inherently low rates, it is
entirely possible that the use of high pressures combined
with membrane-development studies will result in favor-
able economic possibilities. A definite advantage is in
the saving of thermal costs over processes which require
vaporization. Future work has to some extent already been
indicated. The most pressing need will be for studies of
operating factors, investigation of available membranes,
and improvement of promising membranes. (auth)

AEROSOLS

210   ORNL-1957

Oak Ridge National Lab., Tenn.
CLOUD CHAMBER FOR COUNTING CONDENSATION
NUCLEI IN AEROSOLS. Bernard G. Saunders. Oct. 27,
1955. 29p. Contract W-7405-eng-26.

In a cloud chamber which measures the concentration of
nuclei in an aerosol, water vapor is supersaturated to
condense on the aerosol particles in a small sample, and
the resulting water droplets are photographed in an
ultramicroscope. The number of droplets can then be
counted in a microprint reader and the relative or absolute
concentration of the aerosol determined. Two types of
expansion cloud chambers may be used, the volume-defined
and the pressure-defined. The system is completely
automatic and operates continuously on a one-minute cycle,
with as many as 4000 exposures being made without atten-
tion. During one cycle a sample of the aerosol is drawn
into the apparatus, a frame of 16 mm motion picture film
is advanced, the cloud chamber expands, and the resulting
droplets are photographed by the illumination of a
synchronized flashtube. The slits which define the ultra-
microscope light beam are interchangeable so that aerosol
concentrations from 200 particles/cm^3 to 2×10^6 particles/
cm^3 can be measured. (auth)

COSMIC RADIATION

211

DETAILED ANALYSIS AND DISCUSSION OF TWO NARROW
SHOWERS OF PAIRS OF CHARGED PARTICLES. A.
Debenedetti, C. M. Garelli, L. Tallone, and M. Vigone (Univ.
of Turin, Italy). Nuovo cimento (10), 2, 220-30(1955).
Aug.

Detailed experimental data on two events consisting of a
narrow shower of pairs of charged particles are reported.
An analysis of the common features of the events points out
some difficulties in the explanation of the phenomenon as an
ordinary cascade shower. Other possible interpretations
are suggested. (auth)

212

A CLOUD CHAMBER OBSERVATION OF A SINGLY
CHARGED UNSTABLE FRAGMENT. G. Alexander, C.
Ballario, R. Bizzarri, B. Brunelli, A. De Marco, A.
Michelini, G. C. Moneti, E. Zavattini, A. Zichichi (Univ. of
Rome, Italy), and J. P. Astbury (Univ. College, London,
England). Nuovo cimento (10) 2, 365-9(1955) Aug.

The experimental arrangement for cloud chamber ob-
servation of cosmic radiation is described. Two events
were observed to have unusual features and are discussed
in detail. Consideration is given to the possibility that they
are decay processes. (B.J.H.)

213

LECTURES ON THE ORIGIN OF COSMIC RAYS. B. Rossi
(Massachusetts Inst. of Tech., Cambridge). Nuovo cimento
(10) 2, Suppl. 1, 275-335(1955).

Lectures on the origin of cosmic rays by B. Rossi at
M. I. T. are presented. Geomagnetic effects on primary
radiation, the mass and energy spectrum, time fluctuations,
and energy flux of cosmic radiation are discussed. Data on
the structure, motion, and magnetic forces of the galaxies
are given. Correlations of solar and cosmic ray phenomena
are made. Galatic theories of the origin of cosmic rays
embodying mean particle life, source strength, and propaga-
tion are advanced. Several models for cosmic phenomena
are reviewed. (D.E.B.)

214

THE ENERGY SPECTRUM OF THE PRIMARY COSMIC
RADIATION. U. Haber-Schaim (Univ. of Bern, Switzerland).
Nuovo cimento (10) 2, Suppl. 1, 336-8(1955).

Two methods for determining the energy spectrum of
primary cosmic radiation in the range 60 to 1000 Bev are
presented. One method employs the range spectrum of
energetic mesons under ground whereas the other is based
on an analysis of stars produced in emulsions at high
altitudes. (D.E.B.)

215

ON DIURNAL VARIATION IN COSMIC-RAY INTENSITY AT
OTTAWA. S. D. Chatterjee and J. N. Bloom (Univ. Coll. of
Science, Calcutta, India). Can. J. Phys. 33, 577-87(1955)
Oct.

Cosmic-ray data from a high pressure integrating ioniza-
tion chamber, obtained at Ottawa, for 129 complete days
during September 1950 to July 1951 are subjected to rigorous
statistical analysis. The barometric coefficient is −0.19%
per mm of Hg for the period covered by this analysis. The
results also indicate a physically significant 24-hr wave in
cosmic-ray intensity, with an amplitude of 0.12% of the
total intensity, having its maximum at about 10.40 A.M.
local mean time. The existence of the semidiurnal wave,
however, is not physically significant. (auth)

216

ON THE POSITIVE TEMPERATURE EFFECT IN THE
COSMIC RADIATION AND THE μ-e DECAY. H. Trefall
(Imperial Coll. of Science and Technology, London). Proc.
Phys. Soc. (London) A68, 893-904(1955) Oct. 1.

It is shown that the positive partial correlation which
exists between the meson intensity at sea level and the
stratospheric temperature can be interpreted as being due
to the μ−e decay. Two 'second-order' effects of the μ−e
decay contribute to the positive temperature effect which is
observed at sea level. One is due to the fact that neither of
the standard pressure levels (the 100 mb and 50 mb levels)

which have been used as reference levels in the analysis of experimental data is a sufficiently good approximation to the mean level of meson production. The other is due to the fact that the survival probability of a μ meson depends on the way in which its energy loss is distributed over the distance which the meson has to traverse. The theoretically predicted values of the positive temperature effect associated with the $\mu-e$ decay are in reasonable agreement with the available experimental results. The observed dependence of the effect on the choice of reference level is also explained. (auth)

217

ON THE MOMENTUM SPECTRUM OF μ-MESONS NEAR SEA-LEVEL AT 24°N. Shuji Fukui (Osaka Univ., Japan). J. Phys. Soc. Japan 10, 735-41(1955) Sept.

The momentum spectrum of μ mesons near sea level and at geomagnetic latitude 24°N has been obtained by means of a magnet cloud chamber. Above 700 Mev/c the results are in agreement with the momentum spectrum derived from Olbert's production spectrum at 24°N. At lower momenta, the spectrum is found to decrease more rapidly than the corresponding spectra derived from differential range measurements. This discrepancy, which is not understood, may be due to some systematic error in either the magnetic deflection or differential range method. (auth)

218

ON THE PENETRATING SHOWERS PRODUCED IN PARAFFIN AND GRAPHITE. Isao Miura (Yagoya Univ., Japan). J. Phys. Soc. Japan 10, 741-8(1955) Sept. (cf. NSA 9-5688)

The production of the penetrating showers in paraffin and graphite was studied by a cloud chamber connected with a hodoscope at an elevation 2760 meters, geomagnetic latitude 25°N. Results indicate: (1) there is an evidence of multiple production of mesons in the collision of an incident nucleon with a hydrogen nucleus; (2) there is no appreciable difference between paraffin and graphite in the projected angle distribution of lightly ionizing shower particles with respect to the primary particles; and (3) the flux of ionizing particles which produce the local penetrating showers is $(3.0 \pm 0.4) \times 10^{-5}/cm^2$. sec. sterad. (auth)

219

EAST-WEST ASYMMETRY OF POSITIVE AND NEGATIVE MESONS AT THE GEOMAGNETIC EQUATOR. F. B. Harris (Massachusetts Inst. of Tech., Cambridge) and I. Escobar V. (Universidad Mayor de San Andres, La Paz, Bolivia). Phys. Rev. 100, 255-68(1955) Oct. 1.

The intensities of positive and negative μ mesons at zenith angles of 45° in the east-west plane and at the vertical have been measured at atmospheric depth 548 g cm^{-2} near the geomagnetic equator. The data are analyzed through use of the empirical production spectrum and unidimensional equation for μ-meson production employed by Sands and by Olbert. A careful theoretical discussion is given, taking into account in detail the various effects arising both from the variation of the geomagnetic cutoff with direction of incidence of the primaries and from the curvature of the trajectories of the mesons in the earth's magnetic field after their production in the atmosphere. It is found that, to bring the 45° and vertical data into accord, it is necessary to assume an rms angle of production of the parent π mesons of $14° \pm 2°$. It is then possible to express the production spectrum, at any geographical

location, by the single equation $G(R') - A[R' + a(M_c)]^{-n}$, where M_c is the cutoff magnetic rigidity for the primaries in a given direction of incidence at that location. The data do not indicate the presence of any appreciable number of negatively charged particles in the primary cosmic radiation. (auth)

220

HIGH-ENERGY ELECTROMAGNETIC PHENOMENA IN COSMIC RADIATION. M. Koshiba and M. F. Kaplon (Univ., of Rochester, N. Y.). Phys. Rev. 100, 327-39(1955) Oct. 1.

Isolated high-energy electron showers in photographic emulsion have been investigated and have yielded the following conclusions: (1) out of 16 cases of isolated electron showers observed to originate from single electron pairs of energy greater than 1 Bev, 2 cases have been found to be anomalous in the sense that they seem to have been initiated by more than 2 photons; one of the two has been analyzed in detail. (2) The discrepancy between the experimental observations and theoretical predictions on the trident process found in a previous work has been obtained again with the additional experimental data of this experiment. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

221   NP-5791
Detroit. Univ.
THE STUDY OF PROPERTIES OF SINGLE CRYSTALS FOR USE AS DETECTORS AND CRYSTAL COUNTERS. S. J. Czyzak, W. M. Baker, R. C. Crane, H. Payne, and J. R. Ignatowski. Oct. 1955. 44p. Project NR-015-218. Contract Nonr-1511 (01).

The properties of single crystals for use as detectors and crystal counters are discussed. Single crystals of CdS and ZnS with and without controlled impurity additions (In, Mn, Pb, and O) were grown. The crystals were examined for index of refraction, absorption coefficient, dielectric constant, resistivity, photoconductivity, rectification, and photovoltaic effects. Also, preliminary experiments on the radiation effects from high-energy electrons were made. (auth)

222   UCRL-3138
California. Univ., Berkeley. Radiation Lab.
CRYSTAL ENERGIES FOR SOME TRANSITION METAL OXIDES. Peter E. Hare and Leo Brewer. Sept. 1955. 14p. Contract W-7405-eng-48.

The lattice energies of some transition metal oxides have been calculated using the Born-Haber cycle and compared with theoretical values. (auth)

223

ON THE INFLUENCE OF THE PACKING ON THE ATOMIC SCATTERING FACTOR BASED ON THE THOMAS-FERMI THEORY. Kwai Umeda and Yasuo Tomishima (Okayama Univ., Japan). J. Phys. Soc. Japan 10, 753-8(1955) Sept.

The influence of the juxtaposition in the crystal on the atomic scattering factor has been investigated on the basis of the Thomas-Fermi (TF) theory, using the TF functions appropriate to the packed neutral atoms. It is pronounced especially for the smaller values of $\sin \theta/\lambda \cdot Z^{-1/3}$. The values of the atomic scattering factor for free neutral atom have been recalculated anew, using the most accurate Miranda values of the free neutral TF function. (auth)

Refer also to abstracts 86, 88, 90, 113, and 501.

ELECTRICAL DISCHARGE

224   AEC-tr-2283

PULSE METHOD OF INVESTIGATING THE BASIC CHARACTERISTICS OF GAS DISCHARGE. B. A. Mamyrin. Translated from Zhur. Tekh. Fiz. 23, 904-12(1953). 16p. Available from Columbia Technical Translation (CL-13535, Item A), White Plains, N. Y.

A method for measuring electron temperatures, charge density, and space potentials by means of probes to which pulse voltages are applied is evaluated. The method permits extending the probe technique to the region of large discharge currents. Data are given on the equipment for making such measurements. (auth)

225   AEC-tr-2284

ON METHODS OF INVESTIGATING THE VELOCITY DISTRIBUTION OF ELECTRONS IN PLASMA. Iu. M. Kagan, G. M. Malyshev, and V. L. Fedorov. Translated from Zhur. Tekh. Fiz. 23, 894-903(1953). 19p. Available from Columbia Technical Translation (CL-13535, Item B), White Plains, N. Y.

Analysis of existing methods of determining the velocity distribution of electrons in gas-discharge plasma shows these methods to be unsatisfactory. A procedure that combines electric and graphic differentiation is proposed. Evaluation of the errors shows that it is possible to determine the form of the distribution function with an accuracy to 10 to 15%. Application of the method shows that electrons in the positive column of a mercury-arc discharge, at a pressure of 0.04 mm mercury and a current of 100 and 250 ma, have a Maxwell distribution of velocities. (auth)

226   AEC-tr-2299

ELEMENTARY PROCESSES TAKING PLACE DURING THE FORMATION OF A HIGH-VOLTAGE IMPULSE DISCHARGE AT LOW PRESSURE. E. M. Reĭkhrudel, A. V. Kustova, and A. G. Zimelev. Translated from Zhur. Tekh. Fiz. 24, 1179-86(1954). 8p. Available from Associated Technical Services (Trans. 53G6R), East Orange, N. J.

An oscillographic study was made of an impulse discharge at voltages from 50 to 110 kv, at pressures from 10^{-4} to 10^{-1} mm of mercury in helium, argon, air and mercury vapor. The distance between electrodes was varied from 5 to 17 cm. On the basis of the relationships obtained relating the time of formation of the discharge and the peak value of the intensity of the current to different factors, two specific characteristics were found for the type of discharge that was studied. The first phase of the discharge shows an essentially non-homogeneous positive space charge density with a maximum at the cathode. This leads to the formation of cathodic portions of the discharge in the first phase of its development. Also, the main role in the formation of a large current density discharge in the first and second phases is played by the positive ion compensation of the negative space charge throughout the whole discharge gap. (auth)

ELECTRONS

227

ON ELECTRON LENSES WITH VERY SMALL SPHERICAL ABERRATION. P. P. Kas'yankov. Zhur. Tekh. Fiz. 25, 1639-48(1955) Sept. (In Russian)

A mathematical treatment is suggested for electron lenses, permitting calculation of a lens of any small number $\epsilon > 0$ with coefficient of spherical aberration of the third order which is less than ϵ and with a field which satisfies conventional conditions. The method consists in characterization of the axially symmetrical electron lens using the paraxial electron trajectory. (tr-auth)

GASES

228   AECU-3091

Los Alamos Scientific Lab., N. Mex.

THE EQUATION OF STATE GASES BY SHOCK WAVE MEASUREMENTS. [PART] II. THE DISSOCIATION ENERGY OF NITROGEN. R. H. Christian, R. E. Duff, and F. L. Yarger. [1954]. 16p. Contract [W-7405-eng-36].

The results of equation of state measurements made behind strong shock waves in nitrogen are consistent only with the higher of the two spectroscopically acceptable values of the dissociation energy of nitrogen, 9.764 ev. (auth)

229   AEC-tr-2279

THE INFLUENCE OF THE INTERACTION BETWEEN PARTICLES ON THE IONIZATION EQUILIBRIUM IN THERMALLY IONIZED GAS. B. L. Timan. Translated from Zhur. Eksptl'. i Teoret. Fiz. 25, 733-37(1953). 6p. Available from Associated Technical Services (Trans. 04G7R), East Orange, N. J.

The ionization equilibrium in a gas at high temperatures and pressures is investigated theoretically. Taking into account interaction between the gas particles leads to the displacement of the ionization equilibrium in the direction of increase in the number of ionized particles with increasing pressure. A comparison with experimental data is made. (auth)

230   AERE-Lib/Trans-557

REGULAR SOLUTIONS OF GASES IN LIQUIDS. II. CONCENTRATED SOLUTIONS OF HYDROGEN AT HIGH PRESSURE. M. G. Gonikberg. Translated by R. J. Richardson from Acta Physicochim. U.R.S.S. 12, 921-30(1940). 8p.

An interpretation is made of data on concentrated solutions of H at high pressures in order to arrive at a theory of concentrated solutions of gases in liquids. (B.J.H.)

INSTRUMENTS

231   AECU-3090

Los Alamos Scientific Lab., N. Mex.

ONE MILLION FRAME PER SECOND CAMERA. MODEL 2 FRAME CAMERA. Berlyn Brixner. [1954]. 18p. Contract [W-7405-eng-36].

The design and construction of a 1,000,000 fps rotating mirror frame camera is described. Twenty-five consecutive pictures 20 mm in diameter can be obtained on a strip of 35 mm film. A resolution of at least 20 lines/mm is obtained on a moderately fast film like Linagraph Shellburst. Accurate synchronization of the event to be photographed is required. The camera has been most useful in the investigation of explosive and related phenomena. (auth)

232   CCC-1024-TR-107

Callery Chemical Co., Penna.

DETERMINATION OF MOLECULAR WEIGHT BY ELEVA-
TION OF BOILING POINT. A. J. Leffler and T. R.
Kendrick, III. May 3, 1955. 9p.

An apparatus has been constructed to determine the
molecular weight of non-volatile liquids and solids using
the principle of boiling point elevation. The equipment
has been used for several determinations and with proper
care will give results to an accuracy of 5%. One improve-
ment of the apparatus is suggested. (auth)

233   CERN-PS/LRF-1

[European Organization for Nuclear Research, Geneva].
PULSE TESTS ON AMPLIFIER VALVES. A. Citron, B.
W. Montague, and E. Zaccheroni. Aug. 26, 1955. 25p.

Tests were made to determine which of several vacuum
tubes is most suitable to give high power under pulse
conditions as required by the Linac and to determine
whether the tube will be able to deliver the required power
at the required gain in a cavity circuit. Tests on Siemens
tube RS 1011 and Telefunken tube RS 722 are described,
and the results of the tests are discussed. On the basis of
the tests, the Siemen tube was chosen as the most suitable.
Characteristic curves on the tubes are given. (B.J.H.)

234   NACA-RM-E51G12

Lewis Flight Propulsion Lab., Cleveland.
A SPECIALLY CONSTRUCTED METALLOGRAPH FOR
USE AT ELEVATED TEMPERATURES. Joe E. Jenkins,
Donald R. Buchele, and Roger A. Long. Sept. 11, 1951.
21p.

A metallographic microscope was developed with provi-
sion for heating a specimen to 1800°F in protective atmos-
pheres, that is, vacuum or gas. A special objective was
constructed of reflecting elements with an unusually long
working distance ($^7/_{16}$ in.) and a high numerical aperture
(0.5). Changes in specimen microstructure were observed
and recorded on 35-millimeter motion-picture film. The
resulting pictures were projected as motion pictures and
individual frames were cut and enlargements made for
close observation. Structural changes upon heating a 0.35%
annealed carbon steel and a 5% tin phosphor bronze speci-
men were observed and recorded. Newly formed microstruc-
tures were revealed by selective vacuum etching and
specimen relief resulting from recrystallization and vary-
ing grain orientation. (auth)

235   NYO-6478

New York Univ., New York. Atomic Energy Commission
   Computing Facility.
NEW YORK UNIVERSITY COMPILER SYSTEM. Roy
Goldfinger. Feb. 10, 1954. 30p. Contract AT(30-1)-
1480.

A compiler which was developed at the AEC Computing
Facility, New York University, for use with the Univac is
described. The compiler was made available in November,
1953, and has since been used successfully in the prepara-
tion of several programs of varying size. Associated with
the compiler are some routines of a "service routine"
nature which are designed specifically to process the kind
of coding with which the compiler deals. At the time of
this writing, work is in progress on other subordinate
routines, and on library routines of general utility. This
manual, then, is an "open-ended" description of a system,
and it is expected that supplementary material will be made
available in the near future. (auth)

236   UCRL-4547

California. Univ., Livermore. Radiation Lab.
RADIOMETRIC CALORIMETRY AT THE LIVERMORE
SITE OF THE UNIVERSITY OF CALIFORNIA RADIATION
LABORATORY. Stuart R. Gunn. July 1, 1955. 18p.
Contract W-7405-eng-48.

A macrocalorimeter and a microcalorimeter, both of the
steady-state resistance-bridge type, are described. The
theory of the method, operating procedures, and per-
formance data are given. (auth)

237

NEW CIRCUIT FOR THE MEASUREMENT OF VERY
SHORT DELAYS. F. Lepri, L. Mezzetti, and G. Stoppini
(Istituto di Fisica dell'Universita, Istituto Nazionale di
Fisica Nucleare, Sezione di Roma, Rome, Italy). Rev.
Sci. Instr. 26, 936-41(1955) Oct.

A circuit for the measurement of time intervals down to
10^{-10} sec is described. The circuit works on the principle
of transforming the delay τ to be measured into a flat-
topped signal whose amplitude is proportional to τ, and
whose length is independent of τ and controllable at will
within wide limits (up to about 100 μsec). The precision
and stability of the circuit are discussed. (auth)

238

CONTINUOUSLY VARIABLE MERCURY DELAY LINE
EQUIPMENT FOR THE MEASUREMENT OF SHORT TIME
INTERVALS. C. Sheer, A. Zinn, and N. Hartmann
(Columbia Univ., New York). Rev. Sci. Instr. 26, 942-5
(1955) Oct.

Equipment is described for the precision measurement of
short time intervals as defined by two successive electrical
pulses. It features two identically constructed mercury
ultrasonic delay lines, one in each of two channels. These
lines are precision built and extensible in length by approxi-
mately 10%. The measurement is made by first adjusting
the lines for equal delay, feeding the pulses into the two
channels, respectively, and then noting the extension of the
line receiving the prior pulse which is required to bring the
two output pulses into coincidence. A continuous range of
measurement of 0 to 40 μsec is available, and the upper
limit can be extended as desired by inserting fixed delays
in one channel externally. Aside from the continuously
variable feature, the instrument is characterized by
relatively high precision capabilities, ease of measurement,
versatility, and reliability of operation. (auth)

ISOTOPES

239

NEW RADIOACTIVE ISOTOPE SCANDIUM-42. H. Morinaga
(Purdue Univ., Lafayette, Ind.). Phys. Rev. 100, 431-2
(1955) Oct. 1.

Potassium metal was bombarded with 18-Mev α particles,
and the activity was counted with an anthracene crystal. A
strong activity with a half life of 0.62 ± 0.05 sec was found
and concluded to be due to Sc^{42}. A plot of the half lives of
the 0^+-0^+ transitions in A = 4n + 2 positron emitters was
made, and the half life of Sc^{42} lies right on the curve,
suggesting that the 0^+ state is the ground state. According
to a semi-empirical formula, the positron end point
should be 5.70 Mev. (M.P.G.)

MASS SPECTROGRAPHY

240

FORMATION OF NEGATIVE IONS IN THE APERTURE OF THE SOURCE OF MASS-SPECTROMETERS. S. E. Kupriyanov and V. K. Potapov. (Karpov Physico Chemical Research Inst.). Doklady Akad. Nauk S.S.S.R. 103, 449-52 (1955) July 21. (In Russian)

MATHEMATICS

241   IDO-16223

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

FINITE REPRESENTATIONS OF BESSEL FUNCTIONS. D. D. Dix. Apr. 20, 1955. 14p. Contract AT(10-1)-205.

Representations of Bessel functions suitable for numerical evaluation on automatic computing machinery are presented. Power series and asymptotic and approximate representations are included. Functions of orders 0 and 1 only are considered, but most of the procedures used are applicable to other orders as well. Formulas are given for bounds on the errors in the various approximations, and numerical tabulations of the values of the bounds in different cases are shown for illustration. (M.P.G.)

242   K-1222

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

A METHOD FOR THE DETERMINATION OF SURFACE AREA. W. C. DeMarcus, E. H. Hopper, and A. M. Allen. June 14, 1955. 13p. Contract W-7405-eng-26.

A novel method of determining surface area has been recently proposed by G. D. Halsey, Jr., and W. A. Steele. In this report, the calculations are refined by the use of a more realistic interaction potential. An estimation of quantum mechanical effects on the measured surface areas is also carried out and it is found that they are small even for helium. Tables to facilitate the application of the method are included. (auth)

243   KAPL-1399

Knolls Atomic Power Lab., Schenectady, N. Y.

NUMERICAL QUADRATURE OF TRIGONOMETRIC FUNCTIONS. H. Hurwitz, Jr. and P. F. Zweifel. July 13, 1955. 22p. Contract W-31-109-Eng-52.

An improvement to conventional methods for the numerical evaluation of trigonometric integrals is described. (auth)

244   ORNL-1928

Oak Ridge National Lab., Tenn.

MATHEMATICS PANEL SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1955. W. C. Sangren, ed. Sept. 22, 1955. 37p. Contract W-7405-eng-26.

A summary of the work of the Mathematics Panel is presented. Current projects are described, including problems in mathematics, biology, chemistry, physics, health physics, and reactor technology. (For preceding period see ORNL-1842.) (M.P.G.)

245   WIS-ONR-16

Wisconsin. Univ., Madison. Naval Research Lab.

APPLICATIONS OF HIGH-SPEED COMPUTING TO CHEMICAL PROBLEMS. Joseph O. Hirschfelder. Aug. 17, 1955. 12p. Contract N7onr-28511.

Chemical applications of high-speed computing with especial emphasis on the theory of flame propagation are summarized. (auth)

246

THE ELEMENTS OF PROBABILITY THEORY AND SOME OF ITS APPLICATIONS. Harald Cramér. New York, John Wiley and Sons, 1955. 281p.

The elements of the mathematical theory of probability are presented in book form with the emphasis on the theory of random variables and probability distributions. Applications to various fields, particularly to modern statistical methods, are discussed and illustrated by examples. (auth)

247

NON-RELATIVISTIC FORMULAS TO CALCULATE THE ANGULAR CORRELATION COEFFICIENTS OF INTERNAL CONVERSION ELECTRONS AND INTERNAL CONVERSION COEFFICIENTS; DIPOLAR ELECTRICAL TRANSITION. K. A. Ter-Martirosyan. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 315-17(1955). May-June. (In Russian)

Refer also to abstract 373.

MEASURING INSTRUMENTS AND TECHNIQUES

248   AERE-C/R-1646

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SELF-ABSORPTION AND WINDOW-ABSORPTION CORRECTIONS IN THE 2π β-PROPORTIONAL COUNTER FOR CERTAIN FISSION PRODUCTS. J. G. Cuninghame, M. L. Sizeland, and H. H. Willis. July 1955. 30p.

The self-absorption, self-scattering and back-scattering corrections, and the window-absorption corrections have been measured for sixteen commonly used fission product nuclides in a 2π β-proportional methane flow counter. Growth curves have been measured for three of the nuclides, and corrections for conversion electrons have been estimated for four. (auth)

249   AERE-EL/R-1507

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

RADIAC SURVEY METER NO. 2 AND ASSOCIATED TEST EQUIPMENT. J. H. Howes. Aug. 24, 1955. 28p.

This report describes the Radiac Survey Meter No. 2 and its ancillary test equipment. The instrument was designed for use by the British Civil Defence and Service departments as a beta/gamma dose rate measuring instrument. (auth)

250   AERE-NP/R-1720

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FLUX MEASUREMENTS OF FAST NEUTRONS WITH A RECOIL COUNTER IN THE ENERGY RANGE OF 50-2000 KEV. W. D. Allen and A. T. G. Ferguson. June 4, 1955. 24p.

Flux measurements of fast neutrons in the energy range of 50 to 2000 kev have been made with a recoil counter in which the self-consistency for different counters filled with H_2 or CH_4 at different pressures is 2 to 3%. The measurement was crosschecked at 200 kev by comparison with two $RdTh-D_2O$ sources of identical construction but widely differing intensities: the agreement was within 1% and 2% respectively. This report describes the details of the ex-

perimental studies undertaken in the course of the work.
(auth)

251   NP-5786

New York Univ., New York.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA.
Quarterly Progress Report No. 1 for February, March,
April [1955]. Physics Dept. Hartmut Kallmann. Aug.
1955. 118p. Contract DA36-039-sc-64526.

Specific consideration is given to the fluorescence of
organic molecules in various solvents, stimulation and
de-excitation as a function of wavelength and time, and
investigations into trap distribution and non-radiative
transitions. Experimental arrangements are described,
and results for a number of phosphors in various solvents
are given. (For preceding period see NP-5756.) (D.E.B.)

252   NYO-4640

New York Operations Office. Health and Safety Lab., AEC.
EFFECT OF BODY BACK SCATTER ON POCKET
DOSIMETERS AND ATOMIC ENERGY COMMISSION—
HEALTH AND SAFETY LABORATORY FILM BADGES.
Leonard R. Solon and Hanson Blatz. June 1955. 14p.

The AEC-HASL film badge is calibrated in free air
against a Cobalt-60 standard. In the field the badge is
worn on the clothing and in the past, has been exposed most
frequently to the gamma radiation of radium. An experi-
ment has been performed to ascertain whether a correc-
tion for body back scatter is necessary. No such correc-
tion is indicated for the AEC-HASL film badge. A similar
experiment has been performed using self-reading pocket
dosimeters. No important difference could be found be-
tween the response of these instruments to Cobalt-60 or
radium gamma, nor between exposure under free air or
back scatter conditions. (auth)

253

RESOLVING ABILITY OF SCINTILLATION SPECTROM-
ETER. I. F. Barchuk, E. M. Galkin, M. V. Pasechnik and
N. N. Pucherov. (Inst. of Physics U.S.S.R.) Izvest. Akad.
Nauk S.S.S.R. Ser. Fiz. 19, 352-4 (1955). (In Russian)

Two experiments were used to investigate the low
resolving ability of monocrystal scintillation spectrom-
eters with photo multipliers. In one study the scintillation
spectrometer served as a computer which was used as an
electronic monochromator. In the other the spectrometer
was used to measure the spectral contents of electronic
beams. Attempts to increase the resolving ability of the
spectrometer by selection of crystals and multipliers
failed. (R.V.J.)

254

FOR LOW SPECIFIC ACTIVITY: USE SCINTILLATION
COUNTING. C. D. Wagner and V. P. Guinn (Shell
Development Co., Emeryville, Calif.). Nucleonics 13, No.
10, 56-9(1955) Oct.

Various routine methods for determining low radioisotope
concentrations are compared, and it is concluded that good
results are obtained using liquid scintillators or scintilla-
tion dip-counting techniques. (B.J.H.)

255

LOCALIZING SCINTILLATION COUNTING-RATE METER.
Herbert Jonas (Univ. of Virginia Medical School, Charlottes-
ville). Nucleonics 13, No. 10, 64-5(1955) Oct.

A description is given of a scintillation counter which
has proved satisfactory in the study of K^{42} uptake of plants.
(B.J.H.)

256

OPERATING A HURST-TYPE FAST-NEUTRON DOSIMETER
IN HIGH GAMMA FIELDS. J. T. Bracken, E. A. Rollor, and
J. A. Mohrbacher (General Dynamics Corp., Fort Worth,
Tex.). Nucleonics 13, No. 10, 70-3(1955) Oct.

The operating behavior of Hurst-type fast-neutron
dosimeters in high γ fields is discussed, and data are
presented. It is concluded that the dosimeter can be operated
in high γ fields by selecting a combination of anode voltage
and overall gain such that the space charge and coincidence
effects cancel each other. (B.J.H.)

257

THE PHYSICS OF THE SCINTILLATION COUNTER.
G. F. J. Garlick (Univ. of Birmingham, England). J. Sci.
Instr. 32, 369-71(1955) Oct.

The resolution and performance of scintillation counters
used as energy spectrometers are limited by several factors
due to the various physical processes involved. The spread
in output pulse magnitude when detecting monoenergetic
particles is, in the ideal case, due to the statistical fluctua-
tions in the number of photoelectrons produced at the photo-
multiplier cathode and collected by the first multiplying
stage. In practical usage contributions to the pulse spread
may be due in particular to events in the scintillator and in
the secondary emission processes in the multiplier. A
critical discussion of the above factors is given and also of the
problem of non-linear variation of phosphor response with
energy and nature of the incident radiation. (auth)

258

AN APPARATUS FOR THE MEASUREMENT OF γ-RADIA-
TION FROM THE HUMAN BODY. J. Rundo (Finsen Lab.,
Copenhagen, Denmark). J. Sci. Instr. 32, 379-84(1955) Oct.

The design and construction of a total-body γ monitor are
described. It employs four long, high-pressure ionization
chambers connected differentially with four similar chambers
to reduce the background intensity. The chambers are
mounted in a water-filled steel tank, to provide shielding
against local γ radiation. The differential current develops
a potential across a stable high-value resistor, and this
potential is amplified by a vibrating reed electrometer. The
amplified output is displayed on an electromechanical re-
corder and the mean out-of-balance current is determined
automatically. The errors are such that a two-hour meas-
urement of body radioactivity enables the potassium content
of a subject to be determined with a probable error of about
17% under ideal conditions. (auth)

259

RADIOLOGICAL DEFENCE INSTRUMENTS. DESIGN RE-
QUIREMENTS AND RECOMMENDATIONS. Atomics 6,
300-7(1955) Oct.

Some design specifications and performance require-
ments of radiac instruments to be used by NATO countries
are suggested. Specific instrument types that were de-
scribed included survey meters, contamination meters,
flash dosimeters, and personal dosimeters. (C.W.H.)

260

ON INCREASING THE DEGREE OF ACCURACY IN OB-
SERVATION IN THE NUCLEAR PHOTOPLATES. O. V.
Lozhkin. Zhur. Tekh. Fiz. 25, 1341-42(1955) July. (In
Russian)

Discrepancies in the study of nuclear photoplates under
microscope due to the large coefficient of contraction in
the emulsion layer are eliminated by the simple method

which increases descernibility between track intervals by about four times for 3-micron crystals after soaking it in distilled water and drying. (R.V.J.)

261

LIQUID HYDROGEN BUBBLE CHAMBERS. Douglas Parmentier, Jr. and Arnold J. Schwemin (Univ. of California, Berkeley). Rev. Sci. Instr. 26, 954-8(1955) Oct.

Chambers $2\frac{1}{2}$ inches and 4 inches in diameter have been constructed of brass with pyrex ports and sealed with lead-wire gaskets. Metal walls and a copper heat leak eliminate the need for a surrounding pressurized bath. The required fast-pulsing techniques and use of a heat regenerator are described in detail. Schematic diagrams show the chambers, pressure- and temperature-monitoring devices, and illumination method, and photographs of typical tracks and events are included. (auth)

262

HIGH RESOLUTION AUTOMATIC BETA SPECTROMETER. Robert D. Birkhoff, Arthur W. Smith, Harry H. Hubbell, Jr. and Joseph S. Cheka (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 26, 959-62(1955) Oct.

A homogeneous magnetic field beta spectrometer and its completely automatic control system are described. Momentum resolution is such that a monoenergetic line has a full width at half maximum intensity of 0.22%. The instrument was used to analyze the conversion line spectrum of the 411-kev gamma ray from Hg^{198}. The data give for the conversion ratios K:L:M:N values of 1:0.361:0.100:0.027; and for $(L_I + L_{II}):L_{III}$, the value 5.9. (auth)

263

POTASSIUM IODIDE FAST NEUTRON DETECTOR. Bernard Brown (Signal Corps Engineering Labs., Belmar, N. J.). Rev. Sci. Instr. 26, 970-1(1955) Oct.

A fast neutron detector has been developed consisting of powdered thallium activated potassium iodide dispersed in polystyrene. Recoil protons from the polystyrene are detected by potassium iodide. The detection efficiency of the potassium iodide detector for radium-beryllium neutrons is comparable to that of zinc sulphide dispersed in polystyrene. Potassium iodide has a longer decay time than zinc sulfide, permitting "phoswich" coincidence arrangements. The energy response of the potassium iodide detector is closer to the energy response of a thick hydrogenous radiator than that of a zinc sulfide detector. (auth)

264

ON THE DETECTION OF ALPHA PARTICLES WITH ZnS SCINTILLATORS. J. Goldemberg, E. Silva and S. S. Villaca (Univ. of Sao Paulo, Brazil). Anais acad. brasil. cienc. 27, No. 2, 141-50(1955). (In Portugese)

A number of experiments have been carried out in order to find optimum conditions for the utilization of screens of ZnS phosphor in alpha particle counting. Best results were obtained with a collimated beam and a phosphor thickness of the order of the range of the alpha particles inside the screen. The influence of thickness on the counting rate was analyzed and compared with the expected behavior. (auth)

265

THE SCATTERING-IN CORRECTION. B. A. Chartres and D. A. Tidman (Univ. of Sydney, Australia). Proc. Phys. Soc. (London) A68, 841-51(1955) Oct. 1.

A correction is calculated for biased samples of parti-

cles scattered from nuclear emulsions, considering both single and multiple scattering. (L.M.T.)

266

THE VARIATION OF TRACK LENGTH WITH ANGLE OF DIP IN PHOTOGRAPHIC NUCLEAR RESEARCH EMULSION. R. B. J. Palmer and H. A. B. Simons (Royal Free Hospital School of Medicine, London). Proc. Phys. Soc. (London) A68, 852-6(1955) Oct. 1.

Alpha particle and $\alpha + H^3$ tracks have been measured at angles of dip between 0 and 90° in Ilford C2 emulsions. No significant variation in track length with angle of dip has been found except in measurements made with one microscope. A fault in the depth measuring mechanism is shown to account for this effect. (auth)

267

FLUORESCENCE EXTRACTION SPECTRA AND QUANTUM EFFICIENCIES OF ORGANIC CRYSTALS. G. T. Wright (Rhodes Univ., Grahamstown, South Africa). Proc. Phys. Soc. (London) B68, 701-12(1955) Oct. 1.

Fluorescence excitation spectra are measured for some organic crystals using excitation wavelengths down to 2200A. The fluorescence quantum efficiency of crystalline p-terphenyl is found to be constant with wavelength of exciting radiation but apparent variations are found for trans-stilbene and particularly for anthracene crystals. These variations are due to surface escape of fluorescence the extent of which is sensitive to the depth of penetration of the exciting light in crystals which reabsorb their molecular fluorescence. The fluorescence excitation spectrum thus provides information about the absorption spectrum of the crystal. For excitation of the 001 crystal face of anthracene absorption maxima are found at 3960, 3740, 3540, 3370, 3220A; these wavelengths are rather longer than hitherto reported. The first fluorescence maximum lies at 3980 A hence the $0-0$ absorption and fluorescence transitions effectively coincide. Measurements made with an anthracene crystal having a very thin surface quenching layer of low fluorescence efficiency show that migration of electronic excitation energy through the crystal lattice occurs initially by a short range and nonradiative process. Possible transfer mechanisms are discussed and it is concluded that the most probable process is a quantum-mechanical resonance exchange between adjacent molecules resulting in a random diffusion of the excitation energy through the lattice. This is followed by the secondary and trivial process of fluorescence emission and re-absorption. The absolute photofluorescence quantum efficiencies of p-terphenyl and trans-stilbene crystals are measured by comparison with anthracene for which the quantum efficiency is 0.80 ± 0.05. At a temperature of 290°K the efficiencies of p-terphenyl and trans-stilbene crystals are respectively 0.52 and 0.65. (auth)

268

ON THE MEASUREMENT OF IONIZATION IN NUCLEAR PLATES. C. Castagnoli, G. Cortini, and A. Manfredini (Univ. of Rome, Italy). Nuovo cimento (10), 2, 301-13 (1955) Aug.

Measurements of the number of gaps n, total length of gaps x, mean gap length $w = x/n$, and number of "long" gaps n_ϵ, were made on a large number of tracks. Proton, π-meson, and μ-meson tracks coming to rest in a stack of pellicles (the no. 29 stack of Sardinian Expedition 1953) were studied. A rather large velocity interval has been

investigated $(0 < v/c < 0.80)$. The experimental results have been compared with the different theories which have been proposed to describe the formation of tracks of ionizing particles in nuclear emulsions. The problem of choosing the parameter which must be measured in the different velocity intervals in order to obtain the best value of the mass is discussed. It turns out that the best parameters are w in the near minimum region, and x in the "clogged" region. (auth)

269

ENERGY MEASUREMENTS WITH A PLASTIC SCINTILLA-TOR. F. Boreli and B. Grimeland (Inst. of Nuclear Sciences (Boris Kidrich), Belgrade, Yugoslavia). Nuovo cimento (10), 2, 336-9(1955) Aug.

Plastic scintillators consisting of tetraphenyl—butadiene dissolved in polystyrene were studied. The connection between pulse height and particle range for α particles in the scintillators is given. The scintillator characteristics as a neutron detector were studied with 2.5-Mev neutrons, and the resulting proton pulse height and energy distributions are given. Results indicate that resolution is better with anthracene crystals, but that plastic scintillators are advantageous in that they may be obtained in larger sizes. (B.J.H.)

270

THE FAST IONIZATION CHAMBER IN THE STUDY OF α-RADIOACTIVITY IN AIR. U. Facchini and A. Malvicini (Laboratori C.I.S.E., Milan, Italy). Nuovo cimento (10), 2, 340-3(1955) Aug.

Experiments on the determination of α radioactivity in air with a fast ionization chamber are described. Typical spectra from samples of ordinary air and U-contaminated air are shown. (B.J.H.)

271

GAP DENSITY MEASUREMENTS IN NUCLEAR EMULSIONS. F. T. Gardner and R. D. Hill (Univ. of Illinois, Urbana). Nuovo cimento (10) 2, 820-3(1955) Oct.

The technique of gap counting has been extended by using measurements of the variation of the number of gaps with range. This extension is particularly useful in heavily developed G5 emulsions. (auth)

Refer also to abstracts 221, 300, 304, and 381.

MESONS

272   AEC-tr-2294

TOTAL INTERACTION CROSS-SECTIONS OF NEGATIVE π MESONS IN THE 140 TO 400 MEV ENERGY RANGE. A. E. Ignatenko, A. I. Mukhin, E. B. Ozerov, and B. M. Pontecorvo. Translated by V. N. Rimsky-Korsakoff from Doklady Akad. Nauk S.S.S.R. 103, 45-7(1955). 8p.

Accurate measurements of total cross sections of interactions of π⁻ mesons with hydrogen at 140 to 400 Mev have been made using well collimated monoenergetic meson beams. The cross sections were determined by measuring the attenuation of the meson beams passing through paraffin, polyethylene, and graphite. Measurements were made with a system of 4 scintillation counters arranged along the axis of the meson beam. The results show that the total cross section σ_t (π⁻,p) as a function of energy has a maximum at approximately 190 Mev and declines rapidly at higher

energies up to ~300 Mev, thereafter remaining constant. (M.P.G.)

273   AEC-tr-2302

PHOTOPRODUCTION OF π⁰ MESONS FROM DEUTERIUM. A. S. Pelousov, A. V. Kutsenko, and E. I. Tamm. Translated by V. N. Rimsky-Korsakoff from Doklady Akad. Nauk S.S.S.R. 102, 921-3(1955). 9p.

Photoproduction of π⁰ mesons from deuterons is applied to the experimental determination of the relative sign of the interaction constants of a proton and a neutron in a π meson field. Descriptions of experiments are included. (D.E.B.)

274   AEC-tr-2303

INTERACTION OF π⁻ MESONS WITH NUCLEI OF BERYLLIUM, CARBON, AND OXYGEN IN THE ENERGY RANGE FROM 140 TO 400 MEV. A. E. Ignatenko, A. I. Mukhin, E. B. Ozerov, and B. M. Pontecorvo. Translated by Morton Hamermesh from Doklady Akad. Nauk S.S.S.R. 103, 395-7(1955). 6p.

The energy dependence of the total cross section for the interaction of π⁻ mesons with Be, C, O is investigated. Tables and graphs of experimental results are included. (D.E.B.)

275   AEC-tr-2304

ON THE YIELD OF FISSION AND STAR FORMATION AFTER CAPTURE OF π⁻ MESONS BY THE NUCLEI U, Bi, AND W. N. A. Perfilov, O. V. Lozhkin, and V. P. Shamov. Translated by Morton Hamermesh from Doklady Akad. Nauk S.S.S.R. 103, 417-19(1955). 7p.

The ratio of fission and star formation probabilities after π⁻-meson capture by U, Bi, and W was studied by placing these elements, in the form of fine-grained oxides, in the central layer of a three-layer nuclear emulsion. The results of the experiment are tabulated and show the number of stars per fission for U_3O_8, Bi_2O_3, and WO_3 to be 0/2.4, 57, and 133, respectively. (B.J.H.)

276   AERE-Lib/Trans-599

FORMATION OF π⁰ MESONS AT HYDROGEN AND DEUTERIUM BY NEUTRONS OF ENERGY 400 MEV. B. M. Pontecorvo (Pontekorvo) and G. I. Selivanov. Translated by J. B. Sykes from Doklady Akad. Nauk S.S.S.R. 102, 495-7(1955). 4p.

Neutrons of 400 Mev, obtained from the interaction of synchrocyclotron-accelerated protons with Be, were used to study the formation of π⁰ mesons from (n,n) and (n,p) reactions in H and D. Results indicate that π⁰ meson formation in (n,n) collisions has a small probability in comparison with that of π⁰ meson formation in (n,p) collisions. It was concluded that $\sigma \pi^0_{(n,n)} < 10^{-28}$ cm². (B.J.H.)

277   UCRL-Trans-243

RATIO OF POSITIVE AND NEGATIVE HIGH-ENERGY π-MESONS, PRODUCED BY SPLIT NUCLEI. A. V. Krimian. Translated by Theodore Kowalski from Doklady Akad. Nauk S.S.S.R. 103, 229-32(1955). 8p.

Data are reported on the ratio of positive and negative high-energy mesons produced by the neutral components of cosmic radiation in lead. Results indicate that approximately identical numbers of π⁻ and π⁺ mesons are produced in stars generated by neutrons in lead. The ratio appears to be independent of the momenta of the secondary particles for momenta greater than 125 Mev/c. (M.P.G.)

278

BARYON MESON SYSTEM IN PAIS FORMALISM: THE

SCATTERING MATRIX. S. P. Misra (Ravenshaw Coll., Cuttack, India). Indian J. Phys. 29, 243-53(1955) May.

An explicit formulation of the scattering matrix in a formalism introduced by Pais is given. The baryon-meson system, starting from an equation similar to Tomonaga's equation is considered. Selection rules for different processes or Feynman graphs are obtained. (auth)

279

ANALYSIS OF τ-MESONS. P. S. Goel and K. A. Neelakantan (Tata Inst. of Fundamental Research, Bombay, India). Proc. Indian Acad. Sci. A42, 22-7(1955) July.

The decay products of τ mesons in emulsion block detectors have been identified as charged π mesons. Values reported for the decay energy and mass are 76.3 ± 0.3 Mev and 968.7 ± 0.6 m_c, respectively. (C.W.H.)

280

SCATTERING OF PIONS BY HYDROGEN AT 165 MEV. H. L. Anderson and M. Glicksman (Institute for Nuclear Studies, Chicago). Phys. Rev. 100, 268-78(1955) Oct. 1.

Measurements of the elastic scattering of both positive and negative pions, and of the charge exchange scattering of negative pions were carried out at each of five angles, at 165 Mev using a liquid hydrogen target. In addition, the total cross sections for positive and negative pions were measured by the transmission method. Integration of the differential measurements gave total cross sections of 199 ± 11 mb for the positive, and 69.8 ± 3.8 mb for the negative pions. The corresponding cross sections obtained by transmission were 188.2 ± 5.4 mb and 67.5 ± 1.5 mb, respectively. A least squares analysis was carried out on the seventeen data to determine the most probable values of the phase shifts, limiting the analysis to s and p waves. Seven solutions were found, three being of the Fermi type, the others of the Yang type. The Fermi type solutions gave α_{33} near 63°, α_3 near −20°, with the other phase shifts small. (auth)

281

SCATTERING OF POSITIVE PIONS BY HYDROGEN AT 189 MEV. H. L. Anderson, W. C. Davidon, M. Glicksman, and U. E. Kruse (Institute for Nuclear Studies, Chicago). Phys. Rev. 100, 279-87(1955) Oct. 1.

The differential and total cross section of pions on hydrogen has been measured for 189 Mev positive pions. Liquid hydrogen was used as the scatterer; the incident and scattered pions were detected with scintillation counters. The angular distribution was fitted by: $\sigma = (7.24 \pm 0.76) + (3.1 \pm 1.3) \cos\chi + (25.6 \pm 2.6) \cos^2\chi$ millibarns per sterad. The total cross section measured by transmission was 194.1 ± 5.2 millibarns. A phase shift analysis was made using these results in conjunction with data obtained previously on the scattering of negative pions. The analysis was restricted to S and P waves and assumed conservation of isotopic spin. Four solutions were obtained. The one which is consistent with the requirements of causality and which corresponds to the preferred solution of de Hoffmann et al is $\alpha_1 = -2.8° \pm 4.5°$, $\alpha_3 = -11.3° \pm 3.2°$, $\alpha_{11} = 2.6° \pm 7.5°$, $\alpha_{13} = -2.1° \pm 3.8°$, $\alpha_{31} = -11.6° \pm 5.1°$, $\alpha_{33} = 98.8° \pm 3.6°$. (auth)

282

ENERGY DISTRIBUTION OF K MESONS PRODUCED IN NUCLEI. M. M. Block (Naval Research Lab., Washington, D. C.), E. M. Harth (Duke Univ., Durham, N. C.), and R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 324-7(1955) Oct. 1.

K mesons produced by internal target bombardment at the Brookhaven Cosmotron and Berkeley Bevatron are assumed to be made by the reaction: p + N → Y + N + K, where N = nucleon, V = hyperon. The expected energy distribution of the K particles is calculated for several laboratory angles at proton bombarding energies of 2.9 Bev and 4.8 Bev, assuming various angular and energy distributions of the K mesons in the center-of-mass system of the incoming proton and target nucleon. The internal motions of the target nucleons were taken into account by using both the Gaussian and the Fermi momentum distributions. (auth)

283

MASS VALUES OF THE K MESONS. R. W. Birge, J. R. Peterson, D. H. Stork, and M. N. Whitehead (Univ. of California, Berkeley). Phys. Rev. 100, 430-1(1955) Oct. 1.

Additional data have been obtained from the stacks of emulsions exposed to 114- and 170-Mev K mesons. Exposures were made with the use of the strong-focusing magnetic spectrometer. The masses of the K mesons stopped in the stacks have been calculated and are presented in graphical form. Uncertainties and errors in the results are discussed. (M.P.G.)

284

STRONG PION-PION INTERACTION MODEL APPLIED TO PION-NUCLEON SCATTERING IN THE 1-BEV REGION. Gyo Takeda (Univ. of Wisconsin, Madison). Phys. Rev. 100, 440-1(1955) Oct. 1.

The qualitative aspects of the $\pi^\pm$−p cross section in the 1-bev region are discussed using a strong pion-pion interaction model. (M.P.G.)

285

THE LIFETIME OF THE τ-MESON. [Luis] W. Alvarez and S. Goldhaber (Univ. of California Radiation Lab., Berkeley, Calif.). Nuovo cimento (10), 2, 344-5(1955) Aug.

The results of various experiments on the exposure of nuclear emulsions to K particles have been related, yielding a mean life for mesons of $1.0 \pm {}^{0.7}_{0.3} \times 10^{-8}$ seconds. The lifetime of K_L mesons as determined by the same method is not trustworthy, since the scanning efficiency for K_L mesons is not known. (B.J.H.)

286

FURTHER EVIDENCE FOR THE EXISTENCE OF A HEAVY K-MESON OR HEAVY HYPERON. W. F. Fry, J. Schneps, and M. S. Swami (Univ. of Wisconsin, Madison). Nuovo cimento (10), 2, 346-7(1955) Aug.

An example of the K-mesonic decay of a stopped secondary particle was observed in a pellicle stack exposed to cosmic rays, and a photograph of the event is shown. Multiple scattering and grain density measurements result in meson masses of 1,005 ± 200 m_e and 1,024 ± 150 m_e, respectively. Possible decay mechanisms are discussed. (B.J.H.)

287

DOUBLE PION PRODUCTION IN NUCLEON-NUCLEON COLLISIONS. SELECTION RULES FOR PRODUCTION NEAR THE THRESHOLD. R. Gatto (Univ. of Rome, Italy). Nuovo cimento (10), 2, 348-51(1955).

A list is given of the transitions allowed on the basis of Pauli's principle, conservation of parity and angular momentum, and conservation of isotopic spin. Transition matrix elements are also given. (B.J.H.)

288

EVIDENCE FOR NUCLEAR INTERACTION OF CHARGED HYPERON IN FLIGHT. R. D. Hill, F. T. Gardner, and

J. E. Crew (Univ. of Illinois, Urbana). Nuovo cimento (10) 2, 824-7(1955) Oct.

A Σ^- hyperon, arising from a 12 + 0p star, disappears in flight, presumably by interacting with a proton and producing a neutral hyperon and neutron. (auth)

289

A PROBABLE EXAMPLE OF THE REACTION: $\pi^- + p = K^+ + K^- + n$. M. Ceccarelli, M. Grilli, M. Merlin, G. Salandin, and B. Sechi (Univ. of Padova, Italy). Nuovo cimento (10) 2, 828-40(1955) Oct.

An event is described in which a fast singly charged particle produces a star from which the only charged particles emitted are a negative K meson and another particle of ~1000 electronic masses. The interest of the event is due to the fact that this is the first case in which a mechanism of creation of a negative K meson can be specified with a good degree of reliability. The event is shown to be in agreement with the selection rules resulting from associated production ideas. (auth)

290

ANGULAR CORRELATION IN CASCADE DECAY. R. Gatto (Univ. of Rome). Nuovo cimento (10) 2, 841-4(1955) Oct.

The spins and parities of Ξ and Λ° particles are considered on the basis of recently reported angular correlations in cascade decays of the type $\Xi \to \Lambda^\circ + \pi^-$, and $\Lambda^\circ \to p + \pi^-$. (K.S.)

291

AN EXAMPLE OF THE ASSOCIATED PRODUCTION OF A HEAVY MESON AND A HYPERON. P. H. Fowler and W. C. G. Ortel (Institute for Theoretical Physics, Copenhagen, Denmark). Nuovo cimento (10) 2, 864(1955) Oct.

In a large star of the type (22 + 36 α), a heavy meson was found which decays in the K_μ mode, and a hyperon which decays in the Σ mode. The observations on the K meson are consistent with K_μ decay. The hyperon mass, by ionization scattering, is 1.9 ± 0.8 m_p. Assuming a decay scheme of $\Sigma^\pm \to \pi^\pm + n$, Q = 105 ± 17 Mev. (K.S.)

292

NUCLEAR PRODUCTION OF HEAVY UNSTABLE PARTICLES. M. M. Block and R. Jastrow (Naval Research Lab., Washington, D. C.). Nuovo cimento (10) 2, 865-8(1955) Oct.

293

A τ^+ DECAY WITH A VERY LOW ENERGY π^--MESON. W. F. Fry, J. Schneps, G. A. Snow, and M. S. Swami (Univ. of Wisconsin, Madison). Nuovo cimento (10) 2, 872-3(1955) Oct.

294

THE ASSOCIATED PRODUCTION OF A χ-MESON AND A Σ-PARTICLE IN A NUCLEAR DISINTEGRATION. P. H. Fowler and D. H. Perkins (Univ. of Bristol, England). Nuovo cimento (10) 2, 874-5(1955) Oct.

295

LECTURES ON PIONS AND NUCLEONS. E. Fermi. Nuovo cimento (10) 2, Suppl. 1, 17-95(1955).

Original notes from lectures on pions and nucleons by Enrico Fermi at Varenna are presented. The mathematical treatment of nucleon and nucleon-meson systems is considered. (D.E.B.)

296

THE PRODUCTION OF MESONS IN VERY HIGH ENERGY

COLLISIONS. W. Heisenberg (Max-Planck-Institut fur Physik, Gottingen, Germany). Nuovo cimento (10) 2, Suppl. 1, 96-103(1955).

The theory of Landau on meson production in very high-energy collisions is presented, and a comparison is made with the Fermi and Heisenberg theories. (D.E.B.)

297

LECTURES ON PHOTOPRODUCTION. G. Bernardini (Univ. of Rome, Italy). Nuovo cimento (10) 2, Suppl. 1, 104-38 (1955).

Photoelectric production of pions by nucleons is compared with pion-nucleon scattering. The angular distribution of charged and uncharged photopions is discussed, and a mathematical analysis of photopion production is presented. (D.E.B.)

298

PHOTOMESON PRODUCTION FROM HYDROGEN. B. T. Feld (Massachusetts Inst. of Tech., Cambridge). Nuovo cimento (10) 2, Suppl. 1, 139-44(1955).

Characteristics of the reactions $\gamma + p \to n + \pi^+$ and $\gamma + p \to p + \pi^0$ are tabulated and discussed. (D.E.B.)

299

RESULTS ON HEAVY MESONS. M. Ceccarelli (Univ. of Padova, Italy). Nuovo cimento (10) 2, Suppl. 1, 227-30 (1955).

Results of scanning stripped emulsions from the Sardinian expedition are presented. Evidence of K-meson decay into a π meson and the nuclear capture of K mesons is given. (D.E.B.)

300

ON THE IDENTIFICATION OF CHARGED HYPERONS AND THE ESTABLISHMENT OF THEIR DECAY SCHEMES IN NUCLEAR EMULSIONS. A. Bonetti (Univ. of Milan, Italy). Nuovo cimento (10) 2, Suppl. 1, 231-8(1955).

Means of identifying hyperons and establishing their decay schemes from emulsion tracks are discussed. Evidence for certain masses and decay schemes is given. (D.E.B.)

301

COMPARISON OF RESULTS ON K-PARTICLES DISINTEGRATING AT REST IN CLOUD CHAMBERS AND PHOTO-EMULSIONS. C. Dilworth (Univ. of Milan, Italy) and B. Rossi (Massachussetts Inst. of Tech., Cambridge). Nuovo cimento (10) 2, Suppl. 1, 239-46(1955).

Comparisons of K-particle disintegrations in cloud chambers and emulsions are made, and the causes for disagreement in the two experimental methods are advanced on the basis of decay schemes. (D.E.B.)

302

STATISTICAL EVIDENCE CONCERNING THE χ-MESON DECAY. N. Dallaporta (Univ. of Padova, Italy). Nuovo cimento (10) 2, Suppl. 1, 247-8(1955).

Existing data on the decay of χ mesons are summarized. From this evidence, a unique $p\beta$ value of 167.5 ± 6 Mev/c is suggested. Assuming a decay scheme of $\chi \to \pi + \pi^0$, m_χ = 960 ± 18. (D.E.B.)

303

TWO EXAMPLES OF A STAR EMITTING TWO HEAVY UNSTABLE PARTICLES. A. Debenedetti, C. M. Garelli, L. Tallone, and M. Vigone (Istituto Nazionale di Fisica Nucleare, Torin, Italy). Nuovo cimento (10) 2, Suppl. 1, 249-52(1955).

Two examples of a star emitting two heavy unstable particles have been observed. Data for the emission of a τ meson and an excited fragment from a type 21 + 7p star, and for the emission of a K meson and a neutral particle from a type 27 + 9p star are given. Plates of these events are included. (D.E.B.)

304

ON THE MEASUREMENT OF THE MEAN LIFE TIME OF STRANGE PARTICLES. E. Amaldi (Univ. of Rome). Nuovo cimento (10) 2, Suppl. 1, 253-62(1955).

Problems in the measurement of the extremely short life time of some particles are reviewed. The cloud chamber technique of Bartlett is presented, and methods for extending this technique for emulsion use are suggested. Lifetimes, measurements of 10^{-10} sec are considered feasible. (D.E.B.)

305

UNSTABLE FRAGMENTS. R. Levi Setti (Univ. of Milan, Italy). Nuovo cimento (10) 2, Suppl. 1, 263-74(1955).

Examples of delayed disintegration of heavy unstable fragments are cited. Suggested explanations for these events are reviewed, and the decay of a π meson bound to the fragment in place of a neutron is considered. This proposal is justified by an analysis of the nature of the decay products. (D.E.B.)

Refer also to abstracts 212 and 216.

MICROWAVES

306   AEC-tr-2278
ACCURACY OF THE MICROWAVE FREQUENCY STANDARDS. B. D. Osipov. Translated from Zhur. Eksptl'. i Teoret. Fiz. 25, 509-10(1953). 2p. Available from Associated Technical Services (Trans 06G7R), East Orange, N. J.

Equations are given for the accuracy of a stabilized generator. (B.J.H.)

MOLECULAR PROPERTIES

307   AECU-3092
Los Alamos Scientific Lab., N. Mex.
THE HEAT OF COMBUSTION OF CALCIUM. Elmer J. Huber, Jr. and Charles E. Holley, Jr. [1954?]. 9p. Contract [W-7405-eng-36].

Experimental values obtained from combustion measurements for the heat of combustion of Ca and the heat of formation of CaO are 15,649 joules/g and -628.63 ± 0.88 kilojoules/mole, respectively. (C.W.H.)

308   AEC-tr-2298
DEW POINTS OF MIXTURES OF HELIUM ISOTOPES. B. N. Esel'son and N. G. Bereznyak. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 648-9(1954). 2p. Available from Associated Technical Services (Trans. 68G7R), East Orange, N. J.

In order to obtain data for the construction of the vapor-liquid phase diagram of the He^3-He^4 system, the dew points of mixtures of these isotopes were measured. The results are tabulated. (B.J.H.)

309   AEC-tr-2300
SURFACE TENSION OF LIQUID He^3 IN THE TEMPERATURE INTERVAL BETWEEN 0.93 AND 3.34°K. K. N.

Zinov'eva. Translated from Zhur. Eksptl'. i Teoret. Fiz. 28, 125(1955). 2p. Available from Associated Technical Services (Trans. 71G7R), East Orange, N. J.

Surface tension measurements of liquid He^3 were made by the method of capillary rise. The results are shown in graphical form, and a comparison of surface tension coefficients for He^3 and He^4 shows that the character of temperature dependence is the same in the temperature range studied. (B.J.H.)

310

DETERMINATION AND PROPERTIES OF ANISOTROPY IN PARAMAGNETIC RESONANCE ABSORPTION. M. B. Palma Vittorelli, M. U. Palma, D. Palumbo, and M. Santangelo (Univ. of Palermo, Italy). Nuovo cimento (10) 2, 811-19(1955) Oct.

In order to measure the anisotropy in paramagnetic resonance absorption in single crystals, a method has been devised which does not require initial knowledge of the directions of the principal magnetic axes, and by which it is possible to determine the principal values together with the directions of the axes. It is shown that under certain assumptions the characteristic surface of g is an ellipsoid, and that thus, with a proper choice of the axes, the following equation holds: $g = g_x \alpha^2 + g_y \beta^2 + g_z \gamma^2$, where α, β, γ stand for the direction cosines of H. (auth)

311

RANGE-ENERGY RELATION AND MASSES OF THE NEW PARTICLES. David O. Caldwell (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 100, 291-4(1955) Oct. 1.

The accuracy to which the masses of most of the new unstable particles can be determined is now limited principally by the uncertainty in the range-energy relations at large velocities. The extent of this uncertainty is indicated, and the available data are re-examined to try to find the best relations to use. In particular, shell corrections are applied to the Sachs-Richardson data, and the mean excitation potentials for 9 elements are determined. The evidence for Al, Cu, and emulsion indicates that the mean excitation potentials are not velocity dependent, and that they may be considerably larger than the values commonly used. (auth)

Refer also to abstract 69.

NEUTRONS

312   NYO-6268
Nuclear Development Associates, Inc., White Plains, N. Y. A SOLUTION OF THE NEUTRON TRANSPORT EQUATION. PART II: NDA—UNIVAC MOMENT CALCULATIONS. J. Certaine. May 31, 1955. 68p. Contract AT(30-1)-862. (NDA-15C-53)

The techniques used in the UNIVAC phase of the NDA Fundamental Neutron Penetration Program are described. The procedure entails the calculation of the spatial and angular moments of the angular number flux. The assumption made in this treatment of the degradation process is that, for each element, the product of the scattering cross section times a given moment is approximable by a sectionally linear function of lethargy. With the existing UNIVAC code one can calculate the moments of the total angular number flux at equally spaced points in lethargy for a point isotropic continuous energy source. A detailed exposition of the various mathematical steps is included,

together with some numerical results illustrative of the accuracy obtained in the calculations. Other applications of the method are also given. (auth)

313   WAPD-TN-517(Pt.II)
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
NEPTUNE. PART II. RESULTS. A SLOWING DOWN IN WATER. B. THE ZERO-ZERO MOMENT OF THE COLLISION DENSITY. C. TRANSMISSION THROUGH AND REFLECTION FROM WATER SLABS. A. Foderaro and F. Obenshain. Sept. 1955. 24p.

Complete histories of the impacts of neutrons slowing down from 0.89 Mev to 1 ev in a water moderator have been stored on UNIVAC tape. The tapes have been run through the computer to obtain information on neutron slowing down in water, the zero-zero moment of the collision density, and transmission through and reflection from water slabs. Results are compared with those obtained from theoretical expressions. (M.P.G.)

314
ENERGY SPECTRUM OF NEUTRONS PRODUCED IN THE $Li^7(d,n)Be^8$ REACTION. II. J. Catala, J. Aguilar, and F. Senent. Anales real. soc. españ. fís. y quim. (Madrid) Ser. A 51, 173-84(1955) July-Aug. (In Spanish)

The photographic plate method has been used in the study of the neutrons produced in the disintegration of lithium by deuterons. Only the lower neutron spectrum corresponding to the higher energy levels in Be^8 have been studied. The spectrum shows many peaks which stand out on a continuous background. A discussion of all the possible (d,n) reactions is given, and strong evidence is shown for four energy levels in Be^8 and two energy levels in Be^7. (auth)

315
THE THERMAL NEUTRON-CAPTURE CROSS-SECTION OF RADIUM-223. Garman Harbottle (Brookhaven National Lab., Upton, N. Y.). J. Inorg. and Nuclear Chem. 1, 253 (1955) Oct.

The thermal neutron capture cross section of Ra^{223} was calculated to be 125 ± 15 barns. (auth)

316
SLOW NEUTRON RESONANCES OF MANGANESE, BISMUTH, AND SELENIUM. L. M. Bollinger, D. A. Dahlberg, R. R. Palmer, and G. E. Thomas (Argonne National Lab., Lemont, Ill.). Phys. Rev. 100, 126-34(1955) Oct. 1.

The apparatus associated with the Argonne fast neutron "chopper" and techniques that have been developed for its use in neutron transmission measurements are described. Of particular importance is the application of a boron-loaded liquid scintillation counter for the efficient detection of slow neutrons. The nature of the data that are obtained is illustrated by the results given for bismuth, selenium, and manganese. Several techniques for finding neutron resonance parameters and their application to the above data are discussed. Resonance widths are found for the first two levels in bismuth. For the levels in selenium the measurements give only $\sigma_0\Gamma^2$. A complete set of parameters is obtained for the first three manganese resonances. The abnormally large ratio of neutron width to level spacing for manganese produces an unusual shape for the cross-section curve in the neighborhood of the second resonance which is interpreted as being caused by interference between the second and third resonances. For this inter-

pretation we obtain $J = 2$ for $E_0 = 337$ ev, $J = 3$ for $E_0 = 1080$ ev, and $J = 3$ for 2360 ev. (auth)

317
NONELASTIC SCATTERING CROSS SECTIONS FOR FAST NEUTRONS. H. L. Taylor, O. Lönsjö, and T. W. Bonner (Rice Inst., Houston, Tex.). Phys. Rev. 100, 174-80(1955) Oct. 1.

Measurements have been made of the nonelastic cross sections of neutrons in Be, C, Al, Ti, Cr, Fe, Ni, Cu, Ag, Sn, Pb, and Bi. These cross sections include all processes except elastic scattering. The experiments have been carried out with monoenergetic neutrons of 3.5, 4.7, 7.1, 12.7, and 14.1 Mev. The neutrons were produced with a Van de Graaff accelerator using the nuclear reactions: $T^3(p,n)He^3$, $D(d,n)He^3$, and $T^3(d,n)He^4$. Cross sections were determined from transmissions through spherical shells which were 3.8 cm in radius and 2 cm thick. A new type of neutron detector which gives energy information about neutrons and is insensitive to γ radiation was placed at the center of the spherical shell and was used as a biased detector of neutrons. The results of these experiments show that the nonelastic neutron cross section for 12.7- and 14.1-Mev neutrons is nearly geometrical and is closely approximated by $\sigma = \pi(R + \lambda)^2$, where $R = 1.4 \times 10^{-13} A^{\frac{1}{3}}$. The nonelastic cross sections are roughly constant in the energy range 5 to 14 Mev; below about 5 Mev the cross sections begin to decrease. The elastic cross sections can be obtained by subtracting the nonelastic cross sections from the total cross sections. The variations with energy of the nonelastic and elastic cross sections are quite different. Data with 12.7-Mev neutrons and low counter bias give the relative number of γ rays given off per inelastic collision of these neutrons. The number of γ rays decreases rapidly with increasing atomic number and there are less than 5% as many γ rays from Bi as from Al, Ti, Cr, and Fe. (auth)

NUCLEAR PHYSICS

318   AD-41807
[Radiation Research Corp., West Palm Beach, Fla.]
NUCLEAR BATTERIES. Quarterly Progress Report No. 6 [for] October 15, 1953 – January 15, 1954. 24p. DA Project No. 3-99-09-022. Contract DA-36-039-SC-42564.

The conductivities of polystyrene, polyethylene, and mica were measured as a function of temperature under β irradiation. Progress in the design, development, and testing of various models of nuclear batteries is reported. A voltage in excess of 1000 v can theoretically be obtained in a battery using only 2 μc if the polystyrene insulation is previously irradiated with a strong source. (M.P.G.)

319   AECU-2924
Los Alamos Scientific Lab., N. Mex.
NEW VERSION OF FREE NEUTRINO EXPERIMENT
C. L. Cowan, Jr., F. Reines, A. T. Brousseau, F. B. Harrison, and A. R. Ronzio. [1954?] 3p. Contract [W-7405-eng-36].

An experiment is described with which it is hoped that a definitive identification of neutrino-induced inverse neutron decay can be made. The detector consists of 2 sections of proton targets in an aqueous solution of a cadmium salt or in a liquid scintillator between 3 sections of liquid organic scintillator solution. The total volume of the detector is 6000 liters. The experiment is designed to

take advantage of the characteristics of the positron annihilation and the multiplicity of γ rays from neutron capture in a Cd-loaded scintillator. (M.P.G.)

320 ORNL-1879
Oak Ridge National Lab., Tenn.
PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING MARCH 20, 1955. J. L. Fowler and E. O. Wollan, eds. Oct. 3, 1955. 8p. Contract W-7405-eng-26.

The neutron-induced fission cross sections of U^{234} and U^{236} were measured as a function of neutron energy. The total neutron cross section of F^{19} was measured for neutron energies between 0.5 and 5 Mev. The angular distribution of neutrons elastically scattered by Li^6 and Li^7 is shown. The technique of pulse height analysis was used to study the scattering of neutrons from Ne in the energy region 0.8 to 1.7 Mev. The 17.9-Mev neutrons produced at 0° in the H^3(d,n)He^4 reaction were used to study the angular distribution of n-p scattering. Monoenergetic 5.5-Mev neutrons were used to study the excitation cross section for Zr^{90m} and its decay. The 555-kev γ ray in Cd^{114} was studied to test the semiclassical theory of angular distribution of γ rays following Coulomb excitation. The yields of γ rays from Coulomb excitation were also measured for the eight isotopes of Cd. Data on the energy levels in Si^{28} excited by inelastic proton scattering are given. The 5.5-Mev Van de Graaff was calibrated, and reaction thresholds and Q values using the new calibration were found. Three electron-capturing isotopes, Be^7, Cr^{51}, and Mn^{54}, were studied in an attempt to measure inner bremsstrahlung–γ-ray directional angular correlation. The decay and γ spectrum of 0.8-sec. Zr^{90m} were studied. It is suggested that half-life measurements may be made by means of square-wave activation. The energy spectrum of prompt fission γ rays from U^{235} is given. Neutron diffraction patterns were obtained for samples of UH_3 and UD_3 for temperatures ranging from 20°K to 200°C, and magnetic scattering cross sections of UH_3 are given. The magnetic structure of $MnCl_2$ was studied at low temperatures. The magnetic structure of perovskite-type compounds (La, Ca) MnO_3 is discussed. Ferromagnetic- and antiferromagnetic-moment data for the [(1-x)La,xCa] MnO_3 series of compounds are given. Experiments were completed on the polarization of In^{115} nuclei, and observed changes in neutron transmission of the nuclei are shown. An extension of molecular-field theory to a hexagonal lattice is discussed. The effect of crystalline electric fields on antiferromagnetic transitions is also discussed. Measurements of the ratios of electron-loss to electron-capture cross sections for ions passing through gases were extended to the energy region 3 to 20 kev, and the electron-capture cross section for protons in the various gases was measured from 20 to 200 kev. The recoil spectrometer used to study the Cl^{37} ions produced in the electron capture decay of H^{37} is shown, and data on the charge spectrum of the Cl^{37} ions, the energy of the recoils, and natural widths of the recoil lines are given. Neutron absorption cross sections were measured for Zr^{93}, Am^{241}, and enriched stable platinum isotopes. The fission neutron spectrum of U^{233} was studied between 1.3 and 10 Mev. The energy spectrum of γ rays accompanying the fission of U^{235} is given, and the fission γ-ray spectrometer is described in detail. Gamma-ray dose rates and thermal neutron flux as a function of distance from the Bulk Shielding Reactor are given. Calibra-

tion of the Bulk Shielding Reactor control rods is discussed. The effects of beam holes and partial reflectors adjacent to the Bulk Shielding Reactor on its reactivity are discussed. Discussions are also given on internal conversion, orbital capture, cyclotron calculations, and nuclear forces. (For preceding period see ORNL-1798.) (B.J.H.)

321 AEC-tr-2288
[PROTON-PROTON AND NEUTRON-NEUTRON ELASTIC CROSS SECTIONS]. L. Beretta, C. Villi, and F. Ferrari. Translated by E. U. Kauer from Nuovo cimento (9), 12, Suppl. No. 3, 499-548(1954). 51p.

Data are presented on the elastic collisions between protons and protons in the energy range 0.17 to 435 Mev, and between neutrons and protons in the range 3 to 400 Mev. Graphs of differential and total scattering cross sections are included. (C.W.H.)

322
ON THE CLASSIFICATION OF FUNDAMENTAL PARTICLES. A. Salam (St. John's Coll., Cambridge, England) and J. C. Polkinghorne (Trinity Coll., Cambridge, England). Nuovo cimento (10) 2, 685-90(1955) Oct.

A new four-dimensional isotopic spin formalism is developed for the heavy fundamental particles. All particles correspond to single-valued representations of the rotation group, and there is complete symmetry between the isotopic properties of fermions and bosons. The resulting classification is similar to Gell-Mann's except that the degeneracy in the classification of the K mesons is removed. The forms of the strong interactions are given explicitly. The physical consequences of the theory are discussed in detail. In particular it predicts the existence of a neutral K meson of lifetime $\sim 10^{-19}$ s. A new experimental technique for detecting this particle is suggested. (auth)

323
ON CONSERVATION LAWS IN PRODUCTION AND ANNIHILATION OF ANTINUCLEONS. D. Amati and B. Vitale (Univ. of Rome). Nuovo cimento (10) 2, 719-27(1955) Oct.

The role played by conservation laws and selection rules is analyzed for production and annihilation of antinucleons. The cross sections for these processes are developed in terms of the independent cross sections for the transitions which conserve the total isotopic spin. In addition, the initial and final states are analyzed and selection rules are stated for the different processes. (auth)

324
LECTURES ON FUNDAMENTAL PARTICLES. B. Rossi (Massachusetts Inst. of Tech., Cambridge). Nuovo cimento (10) 2, Suppl. 1, 163-226(1955).

Lectures on fundamental particles delivered by B. Rossi at M.I.T. are presented. A complete listing of particles, their classification, characteristics, methods of production, and decay is given. Methods for obtaining experimental evidence of particle events and techniques for measuring the life of given states are described. (D.E.B.)

325
AN ANALOGUE COMPUTER FOR NUCLEAR REACTIONS. E. S. Shire (Univ. of Cambridge, England). J. Sci. Instr. 32, 391-3(1955) Oct.

Given the energy of the incident particle and the Q value of the reaction, the energy of the emitted particle can be

read directly from the computer for any angle in laboratory or center of mass space. The ratio of the number of particles emitted per unit solid angle in center of mass space to the corresponding number measured in laboratory space can also be read directly. (auth)

326

EFFECTIVE QUANTUM NUMBERS IN d- AND f-SHELLS. Chr. Klixbüll Jørgensen (Univ. of Denmark, Copenhagen). J. Inorg. and Nuclear Chem. 1, 301-8(1955) Oct.

The behavior of the effective nuclear charge Z_* and the effective principal quantum number n_* is investigated, with special emphasis on the beginning of the 3d-, 4f-, and 5f-periods. The screening constants are seen to be so dependent on the net charge of the atom that the value of the concept is impaired. The available data on deviations from the hydrogen model, as derived from atomic spectroscopy and the absorption spectra of metal ions in solution, lead to some conclusions of chemical interest. (auth)

327

DETERMINATION OF SURFACE DEFORMATION OF NUCLEI. L. A. Sliv and L. K. Peker. (Leningrad Physico-Technical Inst.) Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 355-9(1955) May-June. (In Russian)

328

SHELL MODEL WITH INTERMEDIATE COUPLING AND BETA DECAY OF He[6]. A. I. Baz. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 363-4(1955). May-June. (In Russian)

329

A FEASIBLE γ METHOD TO ELIMINATE THE DIFFERENCES OF OPINIONS CONCERNING THE PROBLEMS OF INTERACTION OF NON-RELATIVISTIC NUCLEONS. E. L. Feinberg and D. S. Chernavskiĭ. (Lebedev Fiz. Inst.) Doklady Akad. Nauk S.S.S.R. 103, 421-4(1955) July 21. (In Russina)

Refer also to abstracts 295 and 297.

NUCLEAR PROPERTIES

330   ANL-5480

Argonne National Lab., Lemont, Ill.
MEASUREMENT OF DELAYED NEUTRON YIELDS IN PLUTONIUM, URANIUM-233, URANIUM-238, AND THORIUM RELATIVE TO YIELD IN URANIUM-235. G. S. Brunson, E. N. Pettitt, and R. D. McCurdy. Aug. 1955. 28p. Contract W-31-109-eng-38.

Values obtained for the ratios of delayed neutron yields per fission from the thermal fission of U^{233} and Pu, and the fast fission of U^{233}, Pu, U^{238}, and Th relative to U^{235} are 0.396, 0.360, 0.414, 0.405, 2.23, and 3.09, respectively. The estimated errors in the ratio values ranged from 6 to 18%. (auth)

331   ISC-645

Ames Lab., Ames, Iowa.
QUARTERLY SUMMARY RESEARCH REPORT IN PHYSICS FOR APRIL, MAY, JUNE 1955. Oct. 4, 1955. 28p. Contract W-7405-eng-82.

A scintillation spectrometer study of Sc^{47} shows a γ ray at 167 kev and β groups at 596 and 430 kev. The proposed decay scheme is shown. Radiations from Cl^{34} and $Cl^{34\,m}$ were also studied, and the total positron spectrum

was found to consist of 3 groups. Preliminary results on excitation of W, Au, and $Zn^{67\,m}$ by x ray bombardment are tabulated. A decay scheme is shown for Te^{129}. The resistivity, Hall coefficient, and Hall mobility of a Mg_2Ge crystal are shown. The electrical properties of Mg_2Pb were also studied. The specific heat of Ni is shown from 20°C to 600°C. Magnetic properties of holmium metal were studied from 23°K to 300°K. (For preceding period see ISC-608.) (B.J.H.)

332   NDA-14

Nuclear Development Corp. of America, White Plains, N. Y.
THE WIDTHS AND SPACINGS OF NUCLEAR RESONANCE LINES. Erich Vogt. Apr. 1955. 33p.

The widths and spacings of nuclear resonance lines are discussed. A plot of observed level densities, from 1-Mev neutron capture cross sections, and from computed values given by Weisskopf's formula at 7 Mev, as a function of atomic mass is prepared. Data for known nuclear interactions are presented in table form. (D.E.B.)

333   AEC-tr-2295

TOTAL CROSS-SECTIONS FOR THE PROTON-PROTON INTERACTION IN THE ENERGY INTERVAL 410-660 MEV. V. P. Dzhelepov [Dzelepov], V. I. Moskalev, and B. V. Medved. Translation of a pre-print from I.N.P. of Ac. Sci., U.S.S.R. by M. B. Karelitz and L. W. Smith. 10p.

Experiments to determine the total proton-proton interaction cross section at energies greater than 400 Mev have been performed using a collimated 660 Mev proton beam from a synchrocyclotron. Results are tabulated and indicate that the cross section increases rapidly with energy for energies exceeding 400 Mev. The total cross sections for inelastic processes (meson production) in this energy range have been determined from the measurements and available data on elastic p-p scattering. (M.P.G.)

334   AERE-Lib/Trans-548

POLARISATION IN THE SCATTERING OF PROTONS BY PROTONS. Ya. A. Smorodinskii. Translated by J. B. Sykes from Zhur. Eksptl'. i Teoret. Fiz. 27, 123-4(1954) 3p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-416.

335   AERE-Lib/Trans-569

ON THE SPONTANEOUS FISSION OF THORIUM. A. V. Podgurskaya, V. I. Kalashnikova, G. A. Stolyarov, E. D. Vorob'ev, and G. N. Flerov. Translated by V. Beak from Zhur. Eksptl'. i Teoret. Fiz. 28, 503-5(1955). 6p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-5187.

336   UCRL-Trans-242

THE ALPHA-SPECTRA OF HEAVY ELEMENTS. L. L. Gol'din, E. F. Tret'yakov, and G. I. Novikova. Translated by Richard B. Mudge from Proceedings of a Meeting on Atomic Energy held in Moscow, July 1-5. 1955. p.226-49. 45p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-7905.

337

PAIRING IN SHELL MODELS. M. Umezawa (Univ. of Liverpool, England). Proc. Roy. Soc. (London) A232, 88-104(1955) Oct. 11.

An L-S pairing shell model is proposed for light nuclei. Three types of shell model, that is, super multiplet theory, j-j pairing scheme and the L-S pairing

scheme are compared with respect to the decomposition procedure by group theory, and also are compared in connection with nuclear magnetic moments. It is very likely that in light nuclei the L-S pairing or an intermediate coupling between the L-S pairing and j-j pairing schemes is a very good approximation. (auth)

338

THE ENERGY DISTRIBUTION OF PROTONS FROM THE REACTION Cu(n,p)Ni AT 14 MEV. D. L. Allan (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A68, 925-7(1955) Oct. 1.

Approximate cross sections for the (n,p) reactions at 0° are given for Al, Fe, Co, Ni, Cu, Zn, and Pd. (L.M.T.)

339

A NOTE ON THE SPIN AND PARITY OF 2.69 DAY Au^{198}. L. G. Elliott, M. A. Preston, and J. L. Wolfson (Atomic Energy of Canada Ltd., Chalk River, Ontario). Can. J. Phys. 33, 607-8(1955) Oct.

On the basis of a reanalysis of data it was concluded that a spin and parity assignment of 2− or 3− is consistent with the measured spectral shapes. (auth)

340

INTERNATIONAL VALUES OF EFFECTIVE CROSS SECTIONS OF FISSILE ISOTOPES FOR THERMAL NEUTRONS. Francis Perrin and Emile Gumbel. Compt. rend. 241, 669(1955) Sept. 5. (In French)

The International Conference on the uses of atomic energy has published a list of mean values of neutron absorption and fission cross sections of U^{233}, U^{235}, and Pu^{239}. The absorption cross sections are, respectively, 593 ± 8, 698 ± 10, and 1032 ± 15, and the fission cross sections are 524 ± 8, 590 ± 15, and 729 ± 15 barns. (B.J.H.)

341

EFFECT OF PRESSURE ON NUCLEAR QUADRUPOLE RESONANCE. Daniel Dautreppe and Bernard Dreyfus. Compt. rend. 241, 795-8(1955) Sept. 26. (In French)

A variation of 33 Hz/kg · cm^{-2} of the frequency of quadrupole resonance of Cl^{35} in p-$C_6H_4Cl_2$ was observed. It is explained by variations of rotational frequency with pressure. (tr-auth)

342

INVESTIGATION OF THE ENERGY LEVELS OF THE LIGHT NUCLEI BY MAGNETIC ANALYSIS. L. M. Khromchenko. (Khlopin Radium Inst.) Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 277-93(1955). May-June. (In Russian)

An investigation was made of the energy levels of certain light nuclei in areas of higher excitation. Carbon and oxygen were used as testing materials to check the instruments. Results of experiments with Li^7, Li^8, B^{11}, B^{12}, C^{13}, O^{17}, Mg^{25}, Al^{28} and Si^{29} are given. A reproduction diagram of typical photoplates with the energy spectra of nuclei investigated is shown. 42 references. (R.V.J.)

343

NEW DATA ON COMPARISON OF BINDING ENERGIES IN THE MIDDLE Z NUCLEI. V. A. Kravtsov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 377-84(1955) May-June. (In Russian)

Measurement corrections for energy of reactions of $Kr^{85}(d,p)Kr^{86}$ and $Sr^{86}(\gamma,n)Sr^{85}$ are given. Tables of atomic mass and nucleonic binding energies for nuclei from zinc to cadmium are presented based on recent mass spectrometric data. (R.V.J.)

344

INDEPENDENT-PARTICLE MODEL OF THE NUCLEUS. II. WEAK SURFACE COUPLING. Kenneth W. Ford and Carl Levinson (Indiana Univ., Bloomington). Phys. Rev. 100, 1-12(1955) Oct. 1.

The role of weak surface coupling is discussed for multiparticle nuclear configurations. Matrix elements are given for the standard form of the coupling of nucleons to nuclear surface vibrations. Energy spacings, configuration interaction, magnetic moments, quadrupole moments, and E2 transition rates are discussed, with emphasis on features independent of special details of particle configurations. Magnetic moments, in particular, become orderly when account is taken of variations of surface coupling strength together with a directly induced configuration mixing. Experimental evidence favors the idea that a true weak coupling situation exists for many nuclei near closed shells. In these nuclei, collective quadrupole effects may be appreciable while all other collective effects are negligible. (auth)

345

INDEPENDENT-PARTICLE MODEL OF THE NUCLEUS. III. THE CALCIUM ISOTOPES. Carl Levinson and Kenneth W. Ford (Indiana Univ., Bloomington). Phys. Rev. 100, 13-21(1955) Oct. 1.

The isotopes of calcium of mass number 41, 42, and 43 are analyzed using the methods given in papers I and II of this series. It is found that the experimental data on Ca^{41} and Ca^{42} is sufficient to predict the low-lying odd-parity levels of Ca^{43} as well as the magnetic moment. Detailed agreement between theory and experiment is obtained for the levels of Ca^{43} of spin and parity 7/2$^-$, 5/2$^-$, 3/2$^-$, and 9/2$^-$ and the experimental Schmidt line magnetic moment deviation of 0.595 nm is in agreement with a predicted deviation of 0.60 nm. The relative importance of particle forces and surface forces due to collective motion is investigated, and it is concluded that for the isotopes investigated the surface forces are so weak as to have a negligible effect on the level spacings. As a measure of the upper limit of the strength of the surface forces, the magnitude of $\hbar\omega$ (the surfon energy) is set at $\gtrsim$15 Mev. An effective two-particle interaction potential is derived which differs to some extent from the two-particle scattering potential in that it has a longer range and is more shallow. (auth)

346

GAMMA-RAY AND NEUTRON YIELDS FROM THE PROTON BOMBARDMENT OF BORON. J. K. Bair, J. D. Kington, and H. B. Willard (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 21-4(1955) Oct. 1.

Yield curves of the gamma rays and neutrons resulting from the proton bombardment of boron have been measured for proton energies from approximately 2 to 5 Mev. Both the 0° and 90° yields for the $B^{11}(p,\gamma)C^{12}$ reaction have been measured for the ground state transition and for the transition to the 4.43-Mev state in C^{12}, as has the yield of the 2.14-Mev γ ray resulting from the inelastic scattering of protons on B^{11}. The neutron yield from $B^{11}(p,n)C^{11}$ is given at 0° and for almost 2π solid angle in the forward direction. New levels were observed in the C^{12} compound nucleus at 18.3, 18.39, 18.84, 19.2, 19.41, 19.66, 19.87, 20.25, 20.48, and 20.64 Mev. Preliminary data are given for the $B^{10}(p,n)C^{10}$ and $B^{10}(p,\gamma)C^{11}$ reactions. (auth)

347

ISOTOPIC SPIN IMPURITY IN LIGHT NUCLEI. I. CORE

IMPURITY. William M. MacDonald (Princeton Univ., N. J.). Phys. Rev. 100, 51-7(1955) Oct. 1.

The introduction of isotopic spin impurity by the Coulomb mixing of different nuclear eigenstates of T^2 can occur both through the perturbation of the wave function for nucleons in a J, T = O core by the Coulomb interaction of nucleons in the core, and through the perturbation of the wave function for nucleons outside the core by their Coulomb interaction with nucleons in the core and with each other. In this paper the core impurity, the sum of the squared amplitudes of higher isotopic spin eigenstates (T $\neq$ 0), is calculated for the ground state of N = Z even-even nuclei on the Fermi gas model. The core impurity is found to exceed by a large factor the isotopic spin impurity in the wave function for nucleons outside the core. (auth)

348

GAMMA-GAMMA ANGULAR CORRELATION IN Ba^{134}. Ernest D. Klema (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 66-8(1955) Oct. 1.

The directional angular correlation of the 1367 to 605 kev $\gamma-\gamma$ cascade in Ba^{134} has been measured with a coincidence scintillation spectrometer using NaI detectors. For a dilute cesium chloride aqueous solution source, the observed correlation function, after correcting for the finite angular resolution of the detectors, is given by $W(\theta) = 1 + (0.090 \pm 0.0086)P_2(\cos\theta) - (0.004 \pm 0.013)P_4(\cos\theta)$. From this result it is not possible to assign unambiguously a spin and parity to the 1972-kev level in Ba^{134}, from which the cascade originates. However, the present angular correlation data taken with internal conversion coefficient data for the transitions from this level indicate that it very probably has spin 3 and odd parity. (auth)

349

K-CAPTURE—POSITRON RATIOS FOR THE FIRST-FORBIDDEN TRANSITIONS OF Rb^{84} AND THE RELATIVE PROBABILITIES OF L- AND K-ELECTRON CAPTURE. Joan P. Welker and M. L. Perlman (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 74-80(1955) Oct. 1.

The radiations from Rb^{84} have been investigated by means of scintillation coincidence spectrometer techniques in order to obtain the relative intensities of the various transitions. The energies and abundances of the radiations are 0.44-Mev β^- (5%), 0.81-Mev β^+ (10%), 1.70-Mev β^+ (9%), 0.89-Mev γ (64%), and 1.91-Mev γ (0.9%). [Note added in proof.—The β^- has been shown to be 0.91 Mev (2.5%).] Electron capture populates the level 1.91 Mev above the ground state, competes (54%) with the 0.81-Mev β^+ to populate the level 0.89 Mev above ground, and competes (21%) with the 1.70-Mev β^+ in effecting transitions to the ground state of Kr^{84}. The ratios of K-capture to positron emission for the transition to the 0.89-Mev level ($\Delta I = 0$, yes) and to the Kr^{84} ground state ($\Delta I = 2$, yes) are 5.15 ± 0.38 and 2.06 ± 0.36, respectively. These values are in qualitative agreement with theory. Nucleon configurations of the several states of Rb^{84}, Kr^{84}, and Sr^{84} are discussed. In the decay to the 0.89-Mev level an L/K-capture ratio of 0.12 ± 0.05 was obtained by use of a value, 0.65, for the fluorescence yield of krypton. Alternatively, an experimental value for the fluorescence yield, 0.62 ± 0.03, may be computed if the theoretical L/K-capture ratio is assumed. (auth)

350

NUCLEAR RADIUS AND NUCLEAR FORCES. S. D.

Drell (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 100, 97-112(1955) Oct. 1.

The difference between the radius of the nuclear matter distribution and the nuclear force radius, R $\simeq 1.4A \times 10^{-13}$ cm, for heavy nuclei (A>100) is interpreted as a consequence of the finite range of nuclear forces. Assuming that the nuclear matter distribution coincides with the charge distribution as determined at Stanford ($R_C = 1.12A \frac{1}{3} \times 10^{-13}$ cm is the distance at which the charge density falls to one half value) the nuclear interactions of an incident nucleon are summed up for various proposed internucleon potentials, $V(r)$. Contributions from the spin, charge, and matter polarizations induced in the nuclear distributions by the incident nucleon are evaluated as a test of the convergence of these calculations. The aim is to infer some features of nuclear forces which satisfy saturation requirements and at the same time give rise to an appreciable nuclear attraction for an incident nucleon at R_N. Analyses of the scattering of neutrons and protons by heavy nuclei suggest a nuclear attraction $\gtrsim 14$ Mev at a distance R_N. These considerations are primarily sensitive to the long range behavior of the direct, central part of $V(r)$. The key point which emerges from them is that the nuclear forces must contain long range ($\sim$ meson Compton wavelength) direct, central attractions which will be felt by an incident nucleon at R_N before the shorter range repulsions (hard cores, many-body forces, or exchange interactions), which are responsible for saturation, become effective. Such interactions can be constructed phenomenologically, but are not found in recent meson-theoretically deduced potentials. (auth)

351

INNER BREMSSTRAHLUNG FROM A^{37}. Torsten Lindqvist and Chien-Shiung Wu (Columbia Univ., New York). Phys. Rev. 100, 145-9(1955). Oct. 1.

The continuous gamma-ray spectrum (inner bremsstrahlung) accompanying orbital electron capture in A^{37} has been reinvestigated by the method of scintillation spectroscopy with particular emphasis on the low energy region. The absorption between the source and the NaI crystal is only due to 2 one-mil Al foils. After correcting for NaI crystal detection efficiency, the geometrical factor, the ratio of photoelectric cross section to total cross section, Compton electron backscattering, iodine x-ray escape, absorption and resolution, it is found that the intensity of the extremely low-energy photons is much greater than can be accounted for by Morrison and Schiff's treatment. A better agreement can be obtained if one considers the p-electron capture and takes the Coulomb effect into consideration as shown by Glauber and Martin. (auth)

352

PRECISION ENERGY MEASUREMENTS OF THE GAMMA RAYS FOLLOWING THE DECAY OF Bi^{207}. Avivi I. Yavin and Fred H. Schmidt (Univ. of Washington, Seattle). Phys. Rev. 100, 171-2(1955) Oct. 1.

The external conversion spectrum of the two intense γ rays of Pb^{207} has been examined by means of a high resolution spectrometer. The 1.06-Mev γ ray was found to consist of a single component of energy 1063.43 ± 0.50 kev. The energy of the ground state transition was found to be 568.85 ± 0.30 kev. (auth)

353

ELECTRON CAPTURE DECAY OF Am^{244} AND THE SPON-

TANEOUS FISSION HALF-LIFE OF Pu^{244}. P. R. Fields, J. E. Gindler, A. L. Harkness, M. H. Studier, J. R. Huizenga, and A. M. Friedman (Argonne National Lab., Lemont, Ill.). Phys. Rev. 100, 172-3(1955) Oct. 1.

The branching ratio (electron captures/beta particles) of Am^{244} was determined as $0.039 \pm 0.003\%$. An enriched Pu^{244} sample was isolated from neutron irradiated Am^{243}, and the spontaneous fission half-life of Pu^{244} was found to be $(2.5 \pm 0.8) \times 10^{10}$ years. (auth)

354

SCATTERING OF 22-MEV α PARTICLES BY C^{12}. V. K. Rasmussen, D. W. Miller, and M. B. Sampson (Indiana Univ., Bloomington). Phys. Rev. 100, 181-7(1955) Oct. 1.

The elastic and inelastic scattering of 22-Mev α particles by carbon has been observed at a number of angles. Groups corresponding to the excitation of C^{12} to the known 4.4-, 7.7-, and 9.6-Mev levels were found. There was no evidence for the higher states reported by others, except possibly at ~12.7-Mev excitation. A strong angular dependence and a marked lack of symmetry around 90° was observed. The excitation function for E_α = 20.4 to 22.6 Mev indicates a resonance at E_α = 21.85 ± 0.1 Mev, and the angular asymmetry indicates that there is at least one other level of opposite parity in this region. The Q-value for the second excited state was measured to be -7.64 ± 0.07 Mev. By looking for the appropriate C^{12} recoil ions it was established that this state decays to $Be^8 + \alpha$ with > 80% probability. (auth)

355

PHOTOEXCITATION OF THE ISOMERIC STATE OF INDIUM-115. J. L. Burkhardt, E. J. Winhold, and T. H. Dupree (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 100, 199-202(1955) Oct. 1.

The cross section for photoexcitation of In^{115m} has been measured between 1 and 14 Mev. The cross section is found to rise to a narrow peak at 8 Mev, 2 Mev wide, of maximum value 1.2mb. This peak is interpreted as the result of competition from neutron emission by the excited nucleus. Clear evidence for sharp levels in the excitation cross section is found below 2 Mev, and the integrated cross sections for two levels are determined approximately. (auth)

356

ELECTRO- AND PHOTODISINTEGRATION CROSS SECTIONS OF Cu^{63}. M. B. Scott, A. O. Hanson, and D. W. Kerst (Univ. of Illinois, Urbana). Phys. Rev. 100, 209-14 (1955) Oct. 1.

Highly monoergic electrons from a 22-Mev betatron have been used to study the Cu^{62} activity in a pair of 2-mil copper foils separated by a 10-mil copper radiator. The ratio of the photodisintegration to electrodisintegration in the foils decreases by less than 10% in the region from 14 to 20 Mev. The measured value of F at 20 Mev is 8.6 in reasonable agreement with the extrapolation of previous measurements at higher energies and with the value of 8.38 expected on the basis of simple virtual photon calculations. Analysis of the excitation curves gave a $Cu^{63}(\gamma,n)$ cross section of 80×10^{-27} cm^2 which is 20% below most previous measurements. (auth)

357

ALPHA-ALPHA ANGULAR CORRELATIONS IN B^{11} $(p,\alpha\alpha)He^4$. E. H. Geer, E. B. Nelson, and E. A. Wolick (State Univ. of Iowa, Iowa City). Phys. Rev. 100, 215-23 (1955) Oct. 1.

The angular correlation in the reaction $B^{11}(p,\alpha\alpha)He^4$ has been measured between the α particle emitted from C^{12} and

one of the break-up α particles from Be^8. The measurement was made in a plane at 90 degrees to the proton beam with bombarding energies of 163 and 290 kev. Thin targets of natural boron were used, and the α particles detected with thin scintillation counters. The theoretical correlation functions in the laboratory system were obtained by a numerical integration of the center-of-mass angular correlation functions over the 2.9-Mev level in Be^8. The probability for decay of the C^{12} state was assumed to have the same energy dependence for different angular momenta of the emitted α particle. This energy variation was obtained from the energy spectrum of the α particles. Using the two lowest values of angular momentum for the first α particle, the 163-kev data were found to be consistent with a 2+ state in C^{12}, and 2+ but not 0+ or 4+ in Be^8. The data at 290 kev are not consistent with a pure state of spin $1-$ or $2-$ or $3+$ in C^{12}. They are in agreement with a pure state of 2+ or with a superposition of states at this energy. (auth)

358

DECAY OF Cr^{48}. R. van Lieshout, D. H. Greenberg, L. A. Ch. Koerts, and C. S. Wu (Columbia Univ., New York). Phys. Rev. 100, 223-6(1955) Oct. 1.

The nuclide Cr^{48} has been produced by spallation of Ni. It decays by electron capture only with a half life of 23 hours and emits gamma rays of 116 kev (M1) and 305 kev (E2) of equal intensity, which are in coincidence. The genetic relationship with 16.2-day V^{48} establishes the mass assignment. The total decay energy of Cr^{48} can be estimated as 1.45 ± 0.20 Mev. Two alternative decay schemes are proposed. (auth)

359

LOCALIZED ORBITALS IN NUCLEAR STRUCTURE. R. K. Nesbet (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 100, 228-34(1955) Oct. 1.

A generalization of the alpha-particle model of nuclear structure is developed, in which even-even nuclei or inner cores of odd nuclei are built up from localized spatial cells occupied either by two neutrons or by two neutrons and two protons. The analysis used is based on general properties of solutions of Hartree-Fock equations and on the effects of configuration interaction for a neutron-proton system governed by a Hamiltonian of the form $\Sigma K(i) + \Sigma Q(i,j)$. It is not necessary to specify the operators K and Q exactly, except that the interaction operator Q is assumed to be primarily an attractive interaction of short range. A semi-empirical binding energy formula is derived which gives close agreement with observed binding energies for stable even-even nuclei lighter than Ca^{40}. For a reasonable value of a parameter not determined by these data, the energy formula predicts that Ti^{44} should be unstable. (auth)

360

CROSS SECTIONS IN DEUTERIUM AT HIGH ENERGIES. R. J. Glauber (Harvard Univ., Cambridge, Mass.). Phys. Rev. 100, 242-8(1955) Oct. 1.

Recent measurements at high energies indicate that the total cross sections for collisions of both nucleons and π mesons with deuterons are noticeably smaller than the sums of the corresponding cross sections for free neutrons and protons. A formalism for calculating the cross sections of the deuteron is developed, based on the assumption that the interactions of the incident particle with the neutron and proton may individually be treated by the general methods of diffraction theory. The nonadditivity of the free-particle cross sections is shown to be due largely to

"eclipses" in which either the neutron or the proton lies in the shadow cast by the other, an effect in which quantum mechanical diffraction plays an important role. Simple representations of the high-energy interactions and the ground-state wave function of the deuteron are found to lead to cross-section defects of the magnitude observed. (auth)

361

PION PRODUCTION IN PROTON-PROTON COLLISIONS. D. B. Lichtenberg (Univ. of Illinois, Urbana). Phys. Rev. 100, 303-6(1955) Oct. 1.

The cut-off form of the Yukawa theory is applied to the reaction $p + p \rightarrow \pi^+ + d$. Using the Low-Wick formulation of field theory, an expression is obtained for the appropriate matrix element in terms of the wave functions of a physical deuteron and diproton. Approximations are made for these wave functions and the matrix element is evaluated. The resulting cross section agrees semiquantitatively with that part of the observed cross section due to pions emitted in a p-state. (auth)

362

TOTAL CROSS SECTION OF HYDROGEN FOR 150- TO 750-MEV POSITIVE AND NEGATIVE PIONS. S. J. Lindenbaum and Luke C. L. Yuan (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 306-23(1955) Oct. 1.

The total cross section of hydrogen for positive and negative pions of 150 to 750 Mev has been determined. An early preliminary survey using polyethylene-carbon differences is reported and indicated a resonance in the state of isotopic spin and angular momentum equal to $\frac{3}{2}$ (i.e., $T = J = \frac{3}{2}$). A more recent precision determination (~3 to 5%) of the total hydrogen cross section for positive pions in the presumed resonance region (140 to 340 Mev) has been performed using liquid hydrogen transmission measurements. A theoretical analysis of the results in conjunction with other available data strongly supports the hypothesis of a resonance. The behavior of the phase shift of the $T = J = \frac{3}{2}$ state is deduced and given. The most probable solution for the phase shift in this state is found to pass through 90° at ~175 to 180 Mev, although one cannot rule out the possibility of the resonance (90° phase shift) occurring up to 200 Mev. The $T = \frac{1}{2}$ state cross section is found to be zero within the errors in the resonance region and to become appreciable only above 300 Mev. The present experimental data and other relevant work are analyzed in terms of the recent Chew-Low theory and the Brueckner phenomenological resonance theory and is found to fit the general behavior predicted by both, which incidentally is shown to be of similar form. (auth)

363

QUANTUM CALCULATION OF COULOMB EXCITATION. I. L. C. Biedenharn (Rice Inst., Houston, Tex.) and J. L. McHale and R. M. Thaler (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 100, 376-93(1955) Oct. 1.

A complete quantum mechanical treatment for Coulomb excitation is presented. Angular correlations as well as total cross section are developed. The reduction to a form suitable for computation of the radial Coulomb integrals which are needed to evaluate the transition matrix elements is discussed in detail. The relation of the quantum mechanical treatment to the classical treatment is established, and it is shown that the results may be presented as the classical result plus a quantum mechanical correction. (auth)

364

ANGULAR DISTRIBUTION OF GAMMA RAYS IN COULOMB EXCITATION. G. Breit, M. E. Ebel, and F. D. Benedict (Yale Univ., New Haven, Conn.). Phys. Rev. 100, 429(1955) Oct. 1.

Removal of most of the disagreement between experimental and theoretical values of the angular correlation coefficient, a_2, is reported. The formula of Alder and Winther was confirmed except for the sign of one coefficient. Theoretical and experimental values of a_2 for Pt are compared. (M.P.G.)

365

14-MEV (n,α) CROSS-SECTION MEASUREMENTS. H. G. Blosser, C. D. Goodman, T. H. Handley, and M. L. Randolph (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 429-30 (1955) Oct. 1.

Measurements have been made of the 14-Mev (n,α) cross sections of the isotopes Zn^{68}, Zr^{90}, Zr^{94}, and In^{115}. The results are in order-of-magnitude agreement with the predictions of the statistical theory of nuclear reactions. The cross section values obtained were: Zn^{68}, 7.6 ± 0.8 mb; Zr^{90}, 3.3 ± 0.6 mb; Zr^{94}, 3.6 ± 0.5 mb; and In^{115}, 2.5 ± 0.4 mb. (M.P.G.)

366

NEW TYPE OF SELECTION RULES IN β DECAY OF STRONGLY DEFORMED NUCLEI. G. Alaga (CERN, Univ. of Copenhagen, Denmark). Phys. Rev. 100, 432-3(1955) Oct. 1.

The states of nuclei with strongly deformed equilibrium shape can be classified by four quantum numbers: N, the principal quantum number of the oscillator; μ_2, the quantum number of the oscillations along the asymmetry axis; Λ, the component of the particle orbital angular momentum along the symmetry axis; and Ω, the projection of the total particle angular momentum on the symmetry axis. A list of selection rules for allowed and first forbidden β transitions associated with these quantum numbers is given. Tables of data for allowed and first forbidden transitions in odd-A nuclei in the region $150 < A < 190$ are presented. The listed selection rules may also be of help in the discussion of electron-capture transitions. (M.P.G.)

367

COULOMB EXCITATION DIRECTIONAL CORRELATION. M. Goldstein, J. L. McHale, and R. M. Thaler (Los Alamos Scientific Lab., N. Mex.) and L. C. Biedenharn (Rice Inst., Houston, Tex.). Phys. Rev. 100, 436-7(1955) Oct. 1.

It is suggested that quantum calculations of Coulomb excitation directional correlation will resolve the discrepancy between theory and experiment. The Coulomb excitation γ correlation for Cd^{114} has been calculated, and good agreement between theory and experiment was obtained. (M.P.G.)

368

SPATIAL EXTENSION OF THE PROTON MAGNETIC MOMENT FROM THE HYPERFINE STRUCTURE OF HYDROGEN. W. M. Moellering (Physikalische Institut, Heidelberg, Germany), A. C. Zemach and A. Klein (Harvard Univ., Cambridge, Mass.) and F. E. Low (Univ. of Illinois, Urbana). Phys. Rev. 100, 441-2(1955) Oct. 1.

A "magnetic radius" for the proton has been estimated using the theoretical formula for the hyperfine splitting of the ground state of H and an independent measurement of the fine structure constant. (M.P.G.)

369

MAGNETIC MOMENTS OF LIGHT NUCLEI. F. J. Wiśniewski (Lodz, Poland). Nuovo cimento (10), 2, 323-6(1955) Aug. (In French)

Equations are derived for the magnetic moment due to the rotation of the nucleus, treating the nucleus as a solid body. Magnetic moments are calculated for Li^7, Be^9, B^{10}, B^{11}, and N^{14} using these equations, and the results are tabulated and compared to experimental values. Results indicate that these theoretical values are very close to the experimental values. (B.J.H.)

370

PHASE SHIFT ANALYSIS FOR NEGATIVE PION-PROTON SCATTERING AT 187 MEV. E. Clementel, G. Poiani, and C. Villi (Istituti di Fisica dell'Università di Padova e di Trieste, Italy). Nuovo cimento (10), 2, 352-5(1955) Aug.

371

ON THE DIPOLE SELECTION RULE IN O^{16}. G. Morpurgo (Univ. of Rome, Italy) and L. A. Radicati (Univ. of Naples, Italy). Nuovo cimento (10), 2, 360-1(1955) Aug.

The half lives of several transitions in O^{16} were calculated and compared to experimental values. Results indicate that the violation of the dipole rule in these transitions can be accounted for in terms of Coulomb impurity and that nothing can be said at present about the magnitude of the mesonic effect. (B.J.H.)

372

PHENOMENOLOGICAL TREATMENT OF THE DECAY OF LIGHT HYPERFRAGMENTS. R. Gatto (Univ. of Rome, Italy). Nuovo cimento (10), 2, 373-9(1955) Aug.

A phenomenological study is made of the mesonic decay of Λ^0-deuterons. (B.J.H.)

Refer also to abstracts 239, 274, 275, 282, 284, 287, 288, 292, 315, 316, 327, 328, 405, 423, 424, 425, 426, 433, 435, 436, 439, 470, and 479.

NUCLEAR REACTORS

373   AECD-3656

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
PERTURBATION THEORY AND APPLICATIONS. H. L. McMurry. June 11, 1952. Decl. with deletions Dec. 8, 1954. 19p. Contract [AT(10-1)-205].

Perturbation methods for calculating changes in reactivity due to small changes in reactor composition or structure are developed. The equations for the reactivity changes are valid for nonuniform as well as uniform changes in the reactor. They form a convenient basis for interpreting some of the operational characteristics of the MTR. (auth)

374   ANL-5431

Argonne National Lab., Lemont, Ill.
ISOTOPES PRODUCTION REACTOR—SUMMARY OF COMPLETE DESIGN. R. K. Winkleblack. Apr. 1955. 206p. Contract W-31-109-Eng-38.

The Isotope Production Reactor design is summarized. It is hoped that the reactor might be of interest to industrial groups studying the possibilities of entering the radioactive isotopes production field. The critical mass and other pertinent numbers will change according to the isotopes one chooses to produce in this reactor. These necessary changes can be accommodated over a fairly wide range due to the flexibility designed into the core, cooling system, and material handling arrangement. The percentage of enriched uranium in the U—Al fuel plate alloy can be varied. The number of fuel assemblies and the loading pattern can be varied since flow from the plenum chamber can be made available to each of the positions shown. Also, the reactor can be operated at a power considerably above 500 kw if desired. Many safety features are incorporated in the design to assure reliable and safe operation. These include, among others, a cooling water system that will keep the active fuel plates submersed even if a major break occurs in the heavy water system external of the biological shield; an emergency spray system with three sources of cooling water, a large expansion chamber to augment the free volume above the reactor; a fast safety rod system that will "scram" if the reactor reaches a power appreciably above normal operating power or if the rate of change of power should reach a value considered greater than that which is entirely safe; a gastight, blast-resistant building surrounding the reactor but structurally isolated from the reactor and its operating equipment. (auth)

375   DR-32

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE ACCIDENT TO THE NRX REACTOR ON DECEMBER 12, 1952. W. B. Lewis. July 13, 1953. 14p. (AECL-232)

Because of a complex concurrence of mechanical defects in the shut-off-rod system and operating errors which alone would not have caused serious trouble, a power surge occurred in the NRX reactor during preparations for experiments at low power. Some of the cooling arrangements at the time were adequate only for low-power operation. Consequently some of the natural-uranium metal melted and ruptured the aluminum sheathing and tubes which separated the heavy-water, air, and cooling-water systems. As a result some 10,000 curies of fission products from long-irradiated uranium were carried by a flood of 1,000,000 gal of cooling water into the basement. Fused masses of highly irradiated uranium and uranium oxide were left inside the calandria, and the core vessel of the reactor and tubes of the calandria were severely damaged. In such a high-flux reactor where the transient xenon poison may affect the reactivity by 40 milli-k (mk), the shut-off rods have to cover a reactivity range of about 70 mk. As one lesson from the accident it appears preferable to withdraw the first or safeguard bank of shut-off rods soon after shutting down, instead of making this the first step of the actual start-up. (auth)

376   HW-38387

Hanford Atomic Products Operation, Richland, Wash.
NEUTRON FLIGHT THEORY OF BARE CRITICAL REACTORS. G. W. Anthony. Aug. 1, 1955. 25p. Contract W-31-109-Eng-52.

A critical equation for bare reactors containing an arbitrary number of elements is derived. Leakage of neutrons is calculated from isotropic transport theory and it is shown that use of the usual diffusion coefficient, as a measure of leakage, is generally inadequate for hydrogen moderated reactors. Graphical comparison of leakage probabilities shows similar theories consistently to overestimate the leakage of neutrons, the disparity becoming the larger the smaller the reactor. (auth)

377   IDO-16138
Phillips Petroleum Co.   Atomic Energy Div., Idaho Falls,
   Idaho.
NEUTRON FLUX DISTRIBUTIONS IN THE MATERIALS
TESTING REACTOR.   PART II.   THE 5 × 5 LOADING.
G. O. Bright.   Nov. 17, 1953.   Decl. Sept. 12, 1955.   66p.
Contract AT(10-1)-205.

Flux distribution measurements have been made in the
Materials Testing Reactor with the fuel elements arranged
in a symmetrical 5 × 5 loading. Three-dimensional thermal
neutron flux distribution maps were made for both clean,
cold fuel elements and depleted, poisoned fuel elements.
The data are presented as a series of relative activity
curves and as a set of absolute flux maps. A qualitative
comparison of the flux distribution is made between the
5 × 5 loading and the 3 × 9 north slab loading. (auth)

378   IDO-16179
Phillips Petroleum Co.   Atomic Energy Div., Idaho
   Falls, Idaho.
SUMMARY REPORT ON MTR FUEL ASSEMBLY ASSAYS
FROM MAY 1953 TO JUNE 1954. S. G. Forbes.   July 6,
1954. Decl. Sept. 16, 1955. 22p. Contract AT(10-1)-205.

Data on non-destructive assaying of MTR fuel assemblies
are summarized. Comparisons are made between MTR
and ORNL assays. The effects of frequent standardizations
and length corrections are evaluated. Results are tabulated
for over 300 fuel assemblies. (auth)

379   IDO-16210
Phillips Petroleum Co.   Atomic Energy Div., Idaho Falls,
   Idaho.
THE MATERIALS TESTING REACTOR HOT CELL.   M. H.
Bartz and J. B. Burnham, Jr.   July 1954.   20p.   Contract
AT(10-1)-205.

This hot cell can handle 10,000 to 20,000 curies of 1.5
to 3.0-Mev gamma activity. Versatile, it can accomodate
heavy, bulky equipment or delicate, fragile objects for
testing and examinations. The pumice block building
housing the cell provides working and storage areas. The
cell is built of barytes concrete, the walls being 4 ft thick,
lined with $1/4$ in. steel surfaced with protective coatings;
the interior measures $14 \times 6\frac{1}{2} \times 13$ ft high. Three 30 ×
36 in. windows and a smaller end window give maximum
visibility and afford the same shielding as the walls
through use of a 32 in. thickness of zinc bromide solution,
8 in. of high-density glass, and nonbrowning glass. A
General Mills manipulator, a pair of Argonne master-
slaves, and a light crane provide flexible remote handling.
The exhaust system removes up to 1700 cfm of air, and a
separate system exhausts hooded boxes used to handle
volatile or dusty substances. Sliding steel doors 18 in.
thick close the 6 × 7 ft rear opening. The cell and building
were constructed and equipped with windows and manipula-
tors for a total cost of about $268,000. (auth)

380   IDO-16241
Phillips Petroleum Co.   Atomic Energy Div., Idaho Falls,
   Idaho.
MEASUREMENT OF k_{eff} BY THE ROD DROP METHOD.
I.   ELEMENTARY ANALYSIS.   H. L. McMurry.   Sept. 22,
1955. 19p. Contract AT-(10-1)-205.

Attempts to determine the worth of the Materials Testing
Reactor control rods from measurements of the power just
before and just after a rod drop are being made. An
elementary theoretical analysis is presented in which an
approximate formula for k_{eff}, applicable to rod drops

performed at the end of runs, is derived. The amount by
which k_{eff} is reduced below one by the rod drop is a
measure of the worth of the control rods. (auth)

381   IDO-16243
Phillips Petroleum Co.   Atomic Energy Div., Idaho Falls,
   Idaho.
THE MTR AUTOMATIC WIRE SCANNER.   R. J. Preston.
Sept. 29, 1955.   44p.   Contract AT(10-1)-205.

The MTR Automatic Wire Scanner is an integrated de-
sign and simple to use. For routine work an operator
inserts a wire, actuates the drive start switch, selects his
carriage speed, and may then proceed with other work.
The wire scanner automatically handles the complete cycle.
In brief, the wire is carried to the proper position for
scan commencement, wire direction reversed, recorder
turned on, wire scanned automatically according to length,
carriage reversed, shifted to high speed, and automati-
cally returned to the load point. Manual cycles may be run
and manual control may override the automatic cycle at
any time regardless of control configuration. Any wire
position may be relocated within .010 of an inch for re-
checking a point. Wire velocity may be varied from $1/4$ inch
per minute to 5 inches per minute, and panel lamps indicate
control configurations at all times. Wire resolution with
activities under 500 counts per second is excellent and only
slight evidence of end effect may be noted. With higher
activities, however, end effect becomes appreciable. For
this reason and because of the health physics problems of
handling very hot wires, irradiation times are used which
result in activities of the order of 50,000 counts per second
per inch of wire. It also happens that these times are
sufficiently long that good timing accuracy may be easily
achieved. (auth)

382   UCRL-4454
California.   Univ., Livermore.   Radiation Lab.
KINETICS OF SUBCRITICAL ASSEMBLIES.   Harmon W.
Hubbard.   Feb. 25, 1955.   Decl. July 29, 1955.   10p.
Contract W-7405-eng-48.

The time behavior of a subcritical assembly of fissile
material, including delayed neutrons, is investigated. A
normal mode source is turned on at t = 0 and the neutron
population calculated as a function of time. For multipli-
cations small compared to $1 + 1/\beta$ (135 for U^{235}), the ex-
ponential period is approximately the characteristic fast
period $\tau/1-k$. For multiplications large compared to
$1 + 1/\beta$, the period is slow $\approx M(\beta/\lambda)$, and for intermediate
cases the results are plotted. (auth)

383
U. S. REACTOR OPERATING HISTORY: 1943—1954.
Richard H. Graham (U. S. Atomic Energy Commission,
Washington, D. C.).   Nucleonics 13, No. 10, 42-5(1955) Oct.

The safety record of 25 AEC nuclear reactors is re-
viewed from 1943 through 1954. Reactor incidents, critical
assembly incidents, and scrams occurring in this period
are described. (B.J.H.)

384
CRITICAL ASSEMBLIES AT LOS ALAMOS. H. C. Paxton
(Los Alamos Scientific Lab., N. Mex.).   Nucleonics 13,
No. 10, 48-50(1955) Oct.

The remotely assembled critical assemblies of bare
fissionable metals at Los Alamos are described. Delayed
neutron studies with the critical assemblies are also
discussed. (B.J.H.)

385

RADIOACTIVE SPECIES INDUCED IN REACTOR COOLING WATER. W. S. Lyon and S. A. Reynolds (Oak Ridge National Lab., Tenn.). Nucleonics 13, No. 10, 60-2(1955) Oct.

Gamma spectrometry, decay studies, and chemical techniques have been used to identify and measure reactor-incuded activities in an ORNL reactor cooling water. The data obtained are summarized. (B.J.H.)

386

WINDOWS FOR VIEWING HANFORD REACTOR FACE. L. T. Pedersen (Hanford Atomic Products Operation, Richland, Wash.). Nucleonics 13, No. 10, 78(1955) Oct.

Cost estimates and characteristics of the windows used to view the Hanford reactor face are discussed. Each window consists of 12 in. of Plexiglas for neutron shielding and 12 in. of lead silicate glass for γ shielding. (B.J.H.)

387

HOW REACTOR TEMPERATURE AND POWER VARY WITH REACTIVITY AND COOLING. H. Gaus and R. Schulten (Max-Planck-Institut fur Physik, Gottingen, West Germany). Nucleonics 13, No. 10, 78-9(1955) Oct.

Equations are given for the variation of reactor temperature and power with reactivity and cooling for a natural uranium graphite reactor. (B.J.H.)

388

FLUX PERTURBATIONS BY MATERIAL UNDER IRRADIATION. William Bradley Lewis (Phillips Petroleum Co., Idaho Falls, Idaho). Nucleonics 13, No. 10, 82-8(1955) Oct.

Flux depressions caused by the presence of various samples in the MTR are discussed, and data are summarized. (B.J.H.)

NUCLEAR TRANSFORMATION

389

A SIMPLE THEORY OF THE $Li^7(\gamma,H^3)He^4$ REACTION. W. Czyz (Jagiellonian Univ., Cracow, Poland). Nuovo cimento (10), 2, 320-2(1955) Aug.

The mechanism of the $Li^7(\gamma,H^3)He^4$ reaction is studied, assuming a two body model, consisting of a triton and an α particle, for Li^7. The triton $-\alpha$-particle interaction is also assumed to be a square-well potential. Interaction cross sections evaluated on these assumptions are given, and results are discussed. (B.J.H.)

390

THE PHOTODISINTEGRATION OF THE DEUTERON AT HIGH ENERGIES AND ASSOCIATED PHENOMENA. B. T. Feld (Massachusetts Inst. of Tech., Cambridge). Nuovo cimento (10) 2, Suppl. 1, 145-50(1955).

The appearance of an isotropic term and an asymmetry about 90° at energies of 10 Mev $\leq E_\gamma \geq$ 50 Mev for the reaction $\gamma + d \rightarrow n + p$ are discussed. Other features of the reaction above 50 Mev are considered, and mechanisms for the reaction are suggested. (D.E.B.)

391

ASYMMETRY IN THE RANGE OF FRAGMENTS FROM FISSION OF HEAVY NUCLEI INDUCED BY RELATIVISTIC PARTICLES. V. P. Shamov and O. V. Lozhkin. (Khlopin Radium Inst.). Doklady Akad. Nauk S.S.S.R. 103, 233(1955) July 11. (In Russian)

392

APPLICATIONS OF THE STATISTICAL THEORY OF PHOTODISINTEGRATION REACTIONS. J. Goldemberg (Univ. of Sao Paulo, Brazil). Anais acad. brasil. cienc. 27, No. 2, 151-65(1955). (In Portugese)

393

COLLISION MATRIX FOR (n,d) AND (p,d) REACTIONS. R. G. Thomas (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 100, 25-32(1955) Oct. 1.

The contributions to (n,d), (p,d) reactions and their inverses from the pickup and stripping mechanisms are considered as corrections to the compound-nucleus or R-matrix theory of nuclear reactions. In an (n,d) reaction, for example, the R-matrix theory neglects the interaction of the incident neutron with the target-nucleus proton "tails" which extend beyond the nuclear radius. The pickup correction to the collision-matrix component, or reaction amplitude, appears as the matrix element of the neglected interaction involving an exact wave function and the approximate wave function of the compound-nucleus system not having the interaction; a distorted-wave Born approximation is used in which the former exact wave function is replaced by one of the latter type with the appropriate radiation condition. An explicit expression is given for the collision-matrix component which, together with the compound-nucleus contribution, can be substituted directly into the formulas of Blatt and Biedenharn for total reaction cross sections and angular distributions. In general, the angular distributions contain interference terms in addition to the straight pickup and compound-nucleus contributions. If the distorted neutron and deuteron spherical partial waves are assumed to depend only on the angular momenta, and not explicity on the total spin and the channel spins, the formula of Tobocman is obtained for the pickup contribution, while Butler's formula is obtained if plane waves are used instead of distorted waves. These are discussions of the various approximations, the exchange terms, and the question of the nuclear radius. (auth)

394

REACTIONS $C^{12}(d,n)N^{13}$ ground state AND $C^{12}(d,t)C^{11}$ UP TO E_d = 20 MEV. D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 100, 32-6(1955) Oct. 1.

The course of the partial cross section for the direct formation of N^{13} in its ground state only in the reaction $C^{12}(d,n)N^{13}$ has been followed up to E_d = 20 Mev by observing the N^{13} activity induced in a stack of polyethylene foils (only the ground state is stable against proton emission). The cross section falls appreciably less rapidly than would be expected for compound nucleus formation and also less rapidly than predicted by simple stripping theory. The cross section at E_d = 8 Mev is 100 mb which is not so large relative to that for the mirror (d,p) reaction as is predicted by simple stripping theory. The reaction $C^{12}(d,t)C^{11}$ has been detected and its total cross section measured from its threshold (E_d = 14.5 Mev) to E_d = 20 Mev where it is 10 mb. The magnitude of this cross section indicates that this is a pickup reaction. (auth)

395

(d,n) REACTIONS IN O^{16} AND N^{14}. J. B. Marion, R. M. Brugger, and T. W. Bonner (Rice Inst., Houston, Tex.). Phys. Rev. 100, 46-51(1955) Oct. 1.

The technique of observing neutron thresholds in (p,n) and (d,n) reactions has been applied to the reactions

$O^{16}(d,n)F^{17}$ and $N^{14}(d,n)O^{15}$. A nuclear resonance absorption magnetometer, in conjunction with a 90° magnetic analyzer, was used to accurately measure the bombarding energies. The $Li^7(p,n)Be^7$ threshold was used as the primary calibration. The energy of the first excited state of F^{17} was found to be 0.499 ± 0.003 Mev; excited states in O^{15} were found at 6.20 ± 0.03, 6.841 ± 0.009, and 6.900 ± 0.009 Mev. Ten broad resonances in the forward yield of neutrons from the reaction $O^{16}(d,n)F^{17}$ have been found in the range of bombarding energies from 1.8 to 4.3 Mev. The cross section for the $N^{14}(d,n)O^{15}$ reaction increases with the deuteron energy in the range 1.1 to 4.5 Mev; a sharp rise in the cross section begins at a bombarding energy of 2.1 Mev. The absolute cross sections for the $O^{16}(d,n)F^{17}$ and $N^{14}(d,n)O^{15}$ reactions were measured. (auth)

396

NEUTRON-INDUCED REACTIONS IN FLUORINE. Jerry B. Marion and Robert M. Brugger (Rice Inst., Houston, Tex.). Phys. Rev. 100, 69-74(1955) Oct. 1.

By measuring the radioactivity produced when F^{19} is bombarded with monoenergetic neutrons, the excitation functions and absolute cross sections have been obtained for the $F^{19}(n,\alpha)N^{16}$ and $F^{19}(n,p)O^{19}$ reactions from energies at which the respective activities were first observed to 8.0 Mev. The occurrence of the (n,α) reaction was first observed at a bombarding energy of 3.1 Mev; the (n,p) reaction was first observed at 4.7 Mev. Several resonances were found in the (n,α) excitation function, while the (n,p) excitation function showed a single maximum at 7.5 Mev. For neutron energies up to 8.0 Mev, the (n,α) reaction cross section is larger than that for the (n,p) reaction by a factor of 2 or greater. (auth)

397

STUDY OF THE NUCLEAR REACTIONS $Sc^{45}(p,n)Ti^{45}$, $Cu^{63}(p,n)Zn^{63}$, $Cu^{65}(p,n)Zn^{65}$, AND $Zn(p,n)Ga$. R. M. Brugger, T. W. Bonner, and J. B. Marion (Rice Inst., Houston, Tex.). Phys. Rev. 100, 84-90(1955) Oct. 1.

The counter ratio method has been applied to the (p,n) reactions for Sc^{45}, Cu^{63}, Cu^{65}, and Zn to determine the Q values for the ground-state thresholds and to locate low-lying states in the residual nuclei. The thresholds for the (p,n) reactions were found to be 2.908 Mev for Sc^{45}, 4.215 Mev for Cu^{63}, 2.169 Mev for Cu^{65}, and 3.749 Mev for Zn^{68}. Other neutron thresholds were found corresponding to excited states in Ti^{45} at 0.743, 1.194, 1.347, 1.460, 1.876, 2.016, 2.430, and 2.555 Mev; in Zn^{63} at 0.191, 0.642, and 1.043 Mev; and in Zn^{65} at 0.78, 1.26, and 1.93 Mev. A threshold was found in the $Zn(p,n)Ga$ reaction which is probably due to a level in Ga^{68} at 0.170 Mev. Cross sections for the yield of neutrons in the forward direction were determined. The yields of neutrons from thin Sc^{45} and Cu^{63} targets were obtained for the proton energy region from the thresholds to 70 kev above these thresholds. McKibben nomographs are given for these two reactions. (auth)

398

STUDY OF THE REACTIONS $T^3(p,n)He^3$, $Li^7(p,n)Be^7$, $Be^9(p,n)B^9$, AND $F^{19}(p,n)Ne^{19}$. J. B. Marion, T. W. Bonner, and C. F. Cook (Rice Inst., Houston, Tex.). Phys. Rev. 100, 91-6(1955) Oct. 1.

A counter ratio study has been made of the (p,n) reactions on T^3, Li^7, Be^9, and F^{19}. The ground state threshold energy for the reaction $F^{19}(p,n)Ne^{19}$ was found to be 4.235 ± 0.005 Mev. Other neutron thresholds were ob-

served which indicated excited states in Be^7 at 0.434 ± 0.004 Mev, in B^9 at 2.326 ± 0.006 Mev, and in Ne^{19} at 0.241 ± 0.004 and 0.280 ± 0.004 Mev. A broad maximum in the yield of slow neutrons from the bombardment of Be^9 was observed which could be due to the three-body breakup, $Be^9(p,pn)Be^8$, or to a broad, even parity state in B^9 at 1.4 Mev. The cross sections for the reactions $Be^9(p,n)B^9$, $B^{11}(p,n)C^{11}$, $C^{13}(p,n)N^{13}$, and $F^{19}(p,n)Ne^{19}$ were measured. (auth)

399

$V^{51}(p,n)Cr^{51}$ REACTION AS A 5- TO 120-KEV NEUTRON SOURCE. J. H. Gibbons, R. L. Macklin, and H. W. Schmitt (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 167-8 (1955) Oct. 1.

The $V^{51}(p,n)Cr^{51}$ reaction provides a usable source of monoenergetic neutrons from 5 to 120 kev. The yield indicates resonances in Cr^{52} with an average spacing of less than 2 kev in this energy range. A preliminary measurement was made of the angular distribution of eleven of the more prominent peaks. (auth)

400

DISTRIBUTION OF THE NUMBER OF PROMPT NEUTRONS FROM THE SPONTANEOUS FISSION OF Pu^{240}. J. E. Hammel and J. F. Kephart (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 100, 190-2(1955) Oct. 1.

A measurement of the distribution of the number of neutrons per fission of Pu^{240} yielded the following probabilities, P_m, for 0,1,2, etc. neutrons: $P_0 = 0.062$, $P_1 = 0.198$, $P_2 = 0.374$, $P_3 = 0.228$, $P_4 = 0.114$, $P_5 = 0.027$, $P_6 = 0.000$. The measurement was made with a liquid scintillation counter. (auth)

401

MAGNETIC ANALYSIS OF THE $Be^9(p,p')*Be^9$ AND $Be^9(p,pn)Be^8$ REACTIONS. C. R. Gossett, G. C. Phillips, J. P. Schiffer, and P. M. Windham (Rice Inst., Houston, Tex.). Phys. Rev. 100, 203-6(1955) Oct. 1.

The energy distribution of protons from the bombardment of Be^9 with protons has been investigated by precision magnetic analysis in the region of excitation from the ground state through the 2.43-Mev state. A broad distribution of protons was found with a cutoff corresponding to a Q of $-1.675 ± 0.002$ Mev in Be^9. The asymmetry of the observed group and the proximity of the observed Q value to the separation energy of a neutron from Be^9 suggests that the group consists of protons from the three body disintegration $*B^{10} \rightarrow Be^8 + p + n$, but the possibility of inelastic scattering to a state in Be^9 cannot be excluded. An excitation energy of 2.432 ± 0.004 Mev was found for the inelastic proton group from the known state, and a natural width ≤1 kev is ascribed to this state from experiments conducted at optimum resolution. (auth)

402

(p,γ) CROSS SECTIONS. Bernard L. Cohen (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 206-8(1955) Oct. 1.

Several (p,γ) cross sections were measured by activation with protons from 8 to 22 Mev. The dependences on incident energy and target mass are very slight, whereas a compound nucleus model would predict variations by many orders of magnitude. It seems probable, therefore, that the observed reactions are due to high-energy gamma transitions taking place prior to compound nucleus formation. The magnitudes involved indicate that these transitions have single-particle dipole matrix elements. (auth)

403

EXCITATION FUNCTION FOR THE REACTION
$Be^9(N^{14},\alpha n)F^{18}$. H. L. Reynolds and A. Zucker (Oak Ridge
National Lab., Tenn.). Phys. Rev. 100, 226–7(1955) Oct. 1.

The cross section for the production of F^{18} by nitrogen
bombardment of beryllium was measured as a function of
energy. The cross section varies from 100 to 200 milli-
barns at energies from 15 to 30 Mev. Below the barrier,
the cross section falls off with decreasing energy in a
manner which indicates a barrier penetration by the entire
nucleus. (auth)

404

(d,p) REACTIONS FROM C^{12} AND C^{13}. J. N. McGruer,
E. K. Warburton, and R. S. Bender (Univ. of Pittsburgh).
Phys. Rev. 100, 235–9(1955) Oct. 1.

Observations have been made of the proton groups result-
ing from the deuteron bombardment of a carbon target en-
riched to 60% in C^{13}. A total of 24 such groups was observed,
of which 11 have been assigned to levels in C^{13} and 13 to
levels in C^{14}. The experimental angular distributions are
compared with the predictions of stripping theory. The ex-
citation values for 12 previously unreported levels have
been obtained with probable errors of ±0.02 Mev. These
levels are at 7.47, 9.50, and 9.90 Mev in C^{13} and at 6.59,
7.35, 8.32, 9.80, 10.43, 10.50, 12.60, 12.85, and 12.96 Mev
in C^{14}. (auth)

405

ANGULAR DISTRIBUTIONS OF PROTONS FROM
$Be^9(He^3,p)B^{11}$. H. D. Holmgren, M. L. Bullock, and W. E.
Kunz (Naval Research Lab., Washington, D. C.). Phys. Rev.
100, 436(1955) Oct. 1.

Reactions induced by particles of intermediate binding
energies such as H^3 and He^3 nuclei may take place by the
formation of a compound nucleus or by some direct process
such as stripping. The angular distributions of protons
from the $Be^9(He^3,p)B^{11}$ reaction have been measured, and
results are presented. The curves exhibit a lack of
symmetry about 90°, indicating that the reaction does not
proceed exclusively through the formation of a compound
nucleus unless levels of opposite parity contribute. (M.P.G.)

Refer also to abstracts 275, 314, 335, 338, 353, 459, 499,
and 500.

PARTICLE ACCELERATORS

406   AECU-3046

Stanford Univ., Calif. Microwave Lab.
DESIGN OF THE BUNCHING SECTION OF THE STANFORD
MARK IV LINEAR ACCELERATOR. J. M. Ponce de Leon.
June 1955. 77p. Contract AT(04-3)-21. (ML-265)

The purposes of a bunching section and methods for
selecting optimum design characteristics are discussed.
(D.E.B.)

407   CERN-PS/ER-42

[European Organization for Nuclear Research, Geneva].
ON THE INFLUENCE OF EDDY CURRENTS IN THE
VACUUM CHAMBER. E. Regenstreif. Sept. 1955. 21p.

The disturbance in H and n due to the currents produced
in the synchrotron vacuum chamber by the time-varying
magnetic field is calculated under simplifying assumptions.
(auth)

408   CERN-PS/FG-2

[European Organization for Nuclear Research, Geneva].
MAGNETIC POWER SUPPLY. POOL CATHODE
MERCURY-ARC CONVERTERS FOR HIGH-ENERGY
PROTON-SYNCHROTRON MAGNET POWER SUPPLIES.
F. Grütter. Aug. 1955. 52p.

The principles of mercury-arc converters are ex-
plained. Consideration is given to the type of tubes and
circuits which may be used for power supplies to high-
energy proton synchrotrons. Possible solutions for the
power supply to the CERN proton synchrotron magnet will
be treated in a further report. (auth)

409   CERN-PS/MM-20

[European Organization for Nuclear Research, Geneva].
INFLUENCE DE LA FORME DES CYCLES D'IMPULSIONS
SUR LE CHAMP REMANENT. MAQUETTES V–VI–VII.
(Influence of the Forms of Impulse Periods on the
Residual Field. Models V–VI–VII). [1955]. 16p.

Results are given on a systematic study of the behavior
of the residual field in models of synchrotron magnets.
Results are given as functions of the parameters which
characterize the impulse periods. (B.J.H.)

410

THE ALTERNATING GRADIENT PROTON SYNCHROTRON.
J. B. Adams (CERN, Geneva, Switzerland). Nuovo cimento
(10) 2, Suppl. 1, 355–74(1955).

A comparison of constant and alternating gradient proton
synchrotrons is made. Results of preliminary design
studies by the CERN group of an alternating gradient
synchrotron are given. Design data for a proposed 25-Bev
machine are listed, and preliminary construction problems
are considered. (D.E.B.)

411

EXPERIMENTAL FACILITIES OF THE CERN PROTON
SYNCHROTRON. A. Citron and M. G. N. Hine (CERN,
Geneva, Switzerland). Nuovo cimento (10) 2, Suppl. 1,
375–91(1955).

A proposed building layout and the experimental facilities
of the CERN proton synchrotron are described. Beam
energies and shielding requirements are reviewed. (D.E.B.)

412

THEORY OF PARTICLE ORBITS IN THE ALTERNATING
GRADIENT SYNCHROTRON. G. Luders (CERN, Geneva,
Switzerland and Max-Planck-Institut fur Physik, Gottingen,
Germany). Nuovo cimento (10) 2, Suppl. 1, 392–402(1955).

Theoretical aspects of particle orbits in the alternating
gradient synchrotron are outlined. (D.E.B.)

413

SYNCHROCYCLOTRONS, AND THE CERN 600 MEV
MACHINE. T. G. Pickavance (Atomic Energy Research
Establishment, Harwell, Berks, England). Nuovo cimento
(10) 2, Suppl. 1, 403–12(1955).

The purpose, advantages, and disadvantages of the CERN
600-Mev synchrocyclotron are discussed. The design of
magnets, radiofrequency systems, vacuum systems, and
shielding facilities for machines of this type are described.
Proposed experimental facilities and the expected perform-
ance of the CERN machine are discussed. (D.E.B.)

414

PROTON LINEAR ACCELERATORS FOR NUCLEAR RE-
SEARCH, AND THE A.E.R.E. 600 MEV PROJECT. T. G.
Pickavance (Atomic Energy Research Establishment,

Harwell, Berks, England). Nuovo cimento (10) 2, Suppl. 1, 413-22(1955).

The proton linear accelerator and the synchrocyclotron are compared. Radiofrequency and focusing problems are discussed, and an outline of the Harwell project is given. (D.E.B.)

415

ON THE PROTON SYNCHROTRON PROJECT AT SACLAY. H. Bruck and R. Levy-Mandel (Commissariat a l'Energie Atomique, France). Nuovo cimento (10) 2, Suppl. 1, 423-41(1955). (In French)

A general discussion is given of the Saclay proton synchrotron employing the principle of strong focusing. Particular topics discussed include a comparison of the orbit characteristics of various machines, the dimensions of the circulation chamber, pulse intensity, economic considerations, consideration of the numerical values of the parameters, and dimension, structure, and field characteristics of the magnet. (B.J.H.)

416

THE ITALIAN DESIGN OF A 1000 MEV ELECTRO-SYNCHROTRON: A COMPARISON BETWEEN THE STRONG AND THE WEAK FOCUSING. G. Salvini (Univ. of Pisa, Italy). Nuovo cimento (10) 2, Suppl. 1, 442-58(1955).

Preparatory to the construction of a 1000-Mev electron synchrotron, the characteristics of strong focusing and constant gradient machines were considered. These considerations are stated, and reasons for a decision in favor of the constant gradient machine by the Pisa group are given. (D.E.B.)

417

A THEORY OF THE CAPTURE IN A HIGH ENERGY INJECTED SYNCHROTRON. E. Persico (Univ. of Rome). Nuovo cimento (10) 2, Suppl. 1, 459-69(1955).

Particles injected into the donut of a synchrotron are either captured by the radio-frequency system or lost against the wall. An attempt is made to calculate the number of captured particles as a function of the radio-frequency peak voltage, width of the donut, and other machine parameters. (D.E.B.)

418

PROTON LINEAR ACCELERATORS FOR NUCLEAR RESEARCH. T. G. Pickavance. Ned. Tijdschr. Natuurk. 21, 190-200(1955) Aug.

A study is being made at Harwell of the economic feasibility of constructing a 600-Mev linear accelerator. A comparison is made of this proposed accelerator with a synchrocyclotron of the same energy on the bases of beam current, cost, reliability, flexibility, and technical difficulties. (L.M.T.)

419

THE PROTON-SYNCHROTRON. C. J. Bakker. Ned. Tijdschr. Natuurk. 21, 201-9(1955) Aug. (In Dutch)

An analysis of stability and focusing problems in proton synchrotrons is presented, and the Cosmotron, Bevatron, and CERN-ontwerp accelerators are compared. (L.M.T.)

420

ENERGY STABILITY OF THE 22-MEV BETATRON AT THE UNIVERSITY OF ILLINOIS. B. M. Spicer and A. S. Penfold (Univ. of Illinois, Urbana). Rev. Sci. Instr. 26, 952-3(1955) Oct.

Data are presented on the short and long term energy

stability of the 22-Mev betatron at the University of Illinois. The data were taken in the course of a detailed study of the $O^{16}(\gamma,n)O^{15}$ yield curve. It is concluded that the machine was often stable to better than ±3 kev for periods of several hours, and that the maximum energy fluctuation which was observed over an eighteen month period was 40 kev at 17 Mev. (auth)

421

THE GLASGOW 340-MEV SYNCHROTRON. W. McFarlane, S. E. Barden, and D. L. Oldroyd (Univ. of Glasgow, Scotland). Nature 176, 666-9(1955) Oct. 8.

Brief descriptions are given of the magnet, focusing equipment, vacuum system, and injection system. Synchronous electron acceleration is obtained by using two quarter-wave coaxial resonators. The synchrotron was found to have an output of 2×10^9 quanta/min. through an aperture of diameter $\frac{1}{4}$ in. situated 125 cm. from the target. (L.M.T.)

RADIATION ABSORPTION AND SCATTERING

422   AERE-Lib/Trans-575

THE SLOWING DOWN AND DIFFUSION OF NEUTRONS IN FINITE MEDIA ACCORDING TO ELEMENTARY DIFFUSION THEORY. L. Trlifaj. Translated by J. B. Sykes from Czechoslov. J. Phys. 5, Pt. 2, 121-32(1955). 17p.

Slowing down and diffusion of neutrons in finite media are considered, using elementary diffusion theory. The diffusion problem for a finite medium with a source of (fast) neutrons in a general form is first solved. The same method is applied to solve the problem of neutron diffusion in a spherically symmetric finite system of two media, with a point source of fast neutrons at the center of symmetry. The conditions are also examined under which a source placed in the first medium behaves almost as a source of thermal neutrons, so far as the second medium is concerned. (auth)

423

ON PION-NUCLEON SCATTERING. E. Clementel and C. Villi (Univ. of Padova and Trieste, Italy). Nuovo cimento (10) 2, 845-9(1955) Oct.

A calculation of pion-nucleon phase shifts is formulated for negative elastic and charge-exchange scattering. (K.S.)

424

ON THE EMISSION OF LOW ENERGY α PARTICLES FROM LIGHT AND HEAVY NUCLEI EXCITED BY 1000-MEV PROTONS. Georges Philbert. Compt. rend. 241, 875-7 (1955) Oct. 3. (In French)

The stars produced in emulsions of various compositions by 1000-Mev protons are classified according to their trajectory lengths. From statistical considerations it is deduced that the proportion of stars having a short branch (α less than 8 Mev) is of the order of 50% for light elements and 14% for heavy elements. (tr-auth)

425

THE ABSOLUTE MEASUREMENT OF DIFFERENTIAL CROSS SECTIONS FOR THE NUCLEAR SCATTERING OF LOW ENERGY RELATIVISTIC ELECTRONS. K. R. Chapman, E. Matsukawa, P. H. Rose, and E. A. Stewardson (Univ. Coll., Leicester, England). Proc. Phys. Soc. (London) A68, 928-9(1955) Oct. 1.

The simultaneous measurement of the intensity of incident and scattered electrons presents difficulties when

these differ by a factor of the order of 10^{-7} or 10^{-8} in the presence of a heavy background. The method described allows the measurement of cross sections down to $\sim 10^{-25}$ cm^2. It consists of using an incident electron beam of some tens of μa, collecting the electrons in an Al Faraday cylinder and measuring them directly by means of an electrometer triode, the total incident beam being measured simultaneously by means of a galvanometer. (L.M.T.)

426

PHASE SHIFTS IN p-p SCATTERING. A. Keller (Univ. of Manchester, England). Proc. Phys. Soc. (London) A68, 930-2(1955) Oct. 1.

A formula has been developed, valid for arbitrary angular momentum, which relates the p-p phase shift to the corresponding n-p phase shift. (auth)

427

AN APPROXIMATION FOR THE HIGH ORDER PHASE SHIFTS IN THE ELASTIC SCATTERING OF SLOW PROTONS IN THE INERT GASES. C. A. Haywood (Univ. Coll., Leicester, England). Proc. Phys. Soc. (London) A68, 932-3(1955) Oct. 1.

The problem is considered by replacing the field due to the electronic charge distribution by a static central field. (L.M.T.)

428

ELASTIC SCATTERING OF 80 KEV NEUTRONS. W. D. Allen and A. T. G. Ferguson (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A68, 940-1(1955) Oct. 1.

Preliminary results are reported for the elastic scattering of 80-kev neutrons by Sn and Sr as a test of the "complex potential" nuclear model at lower energies, since the model proved quite successful at 1 Mev [Feshback, Porter, and Weiskopf, Phys. Rev. 96, 448(1954)]. (L.M.T.)

429

ON THE THEORY OF SCATTERING OF X RAYS IN GASES, LIQUIDS, AMORPHOUS SOLIDS, AND POLYCRYSTALS. I. V. N. Filipovich. Zhur. Tekh. Fiz. 25, 1604-21(1955) Sept. (In Russian)

General principles of scattering of x rays at large and small angles are expressed. The author uses Fourier's method of analysis and Patterson's function ϕ (r) to characterize the structure of the investigated bodies. (R.V.J.)

430

ON THE THEORY OF SCATTERING OF X RAYS IN GASES, LIQUIDS, AMORPHOUS SOLIDS, AND POLY-CRYSTALS. II. V. N. Filipovich. Zhur. Tekh. Fiz. 25, 1622-38(1955) Sept. (In Russian)

General principles of Fourier's method were introduced for deciphering the x-ray pattern of polycrystalline bodies. A general and more accurate theory was developed on expansion of diffraction lines in respect to the crystal size and on certain defects in the lattice. (R.V.J.)

431

SPATIAL DISTRIBUTION OF THERMAL NEUTRONS FROM A POLONIUM—BERYLLIUM SOURCE IN WATER—ZIRCONIUM MIXTURES. William Baer (Westinghouse Electric Corp., Pittsburgh). J. Appl. Phys. 26, 1235-8 (1955) Oct.

The spatial distribution of neutrons emitted by a Po—Be source and moderated by water—zirconium mixtures has been measured for four water—zirconium volume ratios.

From these data, migration areas of source neutrons to energies below the cadmium cutoff have been determined with an uncertainty of $\pm 2\%$. The experimental values of the migration area M^2 are:

Zr/H$_2$O ratio	M^2(cm^2)
0.00	69.6
0.25	81.3
0.50	89.7
1.00	112.8

(auth)

432

GAMMA RAYS EXCITED BY INELASTIC SCATTERING OF NEUTRONS IN VARIOUS ELEMENTS. M. A. Rothman, H. S. Hans, and C. E. Mandeville (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 100, 83-4(1955) Oct. 1.

Neutrons of energy 3.7 Mev have been inelastically scattered in a number of elements. The energies of the γ rays so excited have been measured by scintillation counting and pulse height analysis. In some cases, the cross sections for γ-ray excitation have been calculated. (auth)

433

ANGULAR DISTRIBUTION OF n-p SCATTERING AT 17.9 MEV. A. Galonsky and J. P. Judish (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 121-4(1955) Oct. 1.

The angular distribution of protons bombarded by 17.9 ± 0.1-Mev neutrons was measured at 11 angles from 2.5° to 50° in the laboratory system. At each angle the energy spectrum of protons producing a coincidence of pulses in two proportional counters and a NaI(Tl) crystal was measured in the NaI crystal. Each spectrum has a peak less than 25% wide at half-maximum and a small low-energy tail caused by Coulomb scattering of the protons in the detector. The error in each yield was between 2 and 3% for angles from 2.5° to 45° and 8% at 50°. A least squares fit to the data gives 1.08 ± 0.03 for the ratio of the n-p scattering cross sections at neutron angles 180° and 90° cm. (auth)

434

NUCLEAR SCATTERING OF LOW-ENERGY PHOTONS. J. L. Burkhardt (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 100, 192-8(1955) Oct. 1.

The elastic photon scattering cross sections at 90° for lead, indium, cadmium, and copper have been measured between 0.5 and 3.0 Mev. Besides the expected Rayleigh scattering by bound electrons and Thomson scattering by the nucleus, a scattering component due to nuclear excitation is evident in the cross sections. The mechanism of this scattering is discussed. (auth)

435

CAUSALITY IN THE PION-PROTON SCATTERING. H. L. Anderson, W. C. Davidon, and U. E. Kruse (Institute for Nuclear Studies, Chicago). Phys. Rev. 100, 339-43(1955) Oct. 1.

Dispersion relations applicable to particles with mass and charge have been used for analyzing pion-proton scattering data. In these relations, experimental values of the total cross sections for π^+ and π^- from 0 to 1.9 Bev were used to calculate the real part of the forward scattering amplitudes, and these were compared with the results of phase-shift analyses. With suitable choice of the pion-

nucleon coupling constant, good agreement can be obtained for the phase-shift solutions with a resonant behavior for α_{33}. (auth)

436

SCATTERING OF MESONS BY A FIXED SCATTERER. Freeman J. Dyson (Institute for Advanced Study, Princeton, N. J.). Phys. Rev. 100, 344-8(1955) Oct. 1.

The meson-nucleon scattering equations of Chew and Low are generalized to the case of mesons and scatterers having arbitrary angular momenta. In consequence, the algebraic structure of the equations is made clearer. Two coupling schemes for the angular momenta are studied, the J-scheme in which momenta of meson and scatterer in the initial state are coupled, and the N-scheme in which the meson momenta in initial and final states are coupled. The condition of unitarity of the S-matrix is simple only in the J-scheme, the condition of causality is simple only in the N-scheme. The interlock between the two schemes gives rise to the peculiar linking of different J-values in the Chew-Low equations. The linkage coefficients are shown to be ordinary Racah coefficients. (auth)

437

INELASTIC SCATTERING OF NEUTRONS FROM IRON BY TIME-OF-FLIGHT. L. Cranberg and J. S. Levin (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 100, 434-5 (1955) Oct. 1.

A system of fast-neutron spectroscopy using the time-of-flight principle and a pulsed-beam technique is described. The spectra of arrival times of the scattered neutrons at the detector are presented for Fe and polyethylene scatterers. The cross section for inelastic scattering to a particular level may be determined by comparison with the differential (n,p) scattering cross sections. The cross section obtained from many runs for excitation of the 850-kev level in Fe^{56} by neutrons of 2.45-Mev energy scattered at 90° is 0.085 ± 0.003 barn/steradian. (M.P.G.)

438

SCATTERING OF 30- TO 95-MEV PHOTONS. C. L. Oxley and V. L. Telegdi (Institute for Nuclear Studies, Chicago). Phys. Rev. 100, 435-6(1955) Oct. 1.

The elastic scattering of γ rays by hydrogen has been measured, and the experimental techniques are described. Data were collected at angles from 50 to 150°, and the resulting cross sections are presented in graphical form. The theoretical curve for scattering from a point proton is presented for comparison. Deviations from the theoretical cross section do not greatly exceed the expected amounts. (M.P.G.)

439

POLARIZATION OF 350-MEV NEUTRONS ELASTICALLY SCATTERED FROM NUCLEI. Robert T. Siegel (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 100, 437-8(1955) Oct. 1.

Polarization effects in the scattering of neutrons have been studied in an experiment performed with a 350-Mev, 16% polarized neutron beam. Data are presented for scattering by C, Al, Cu and Pb. The results agree fairly well with experimental results on proton scattering. It is concluded that the sign of the polarization of a neutron beam elastically scattered to the right is the same as that of a proton beam under the same circumstances. This would confirm an earlier assumption that the neutron polarization in n-p scattering has the same sign as the proton polarization in p-n scattering. (M.P.G.)

440

STUDIES ON DIFFUSION. PART I. DIFFUSION OF RADIOACTIVE MATTER THROUGH PLATES. U. Aswathanarayana and S. Ramamurthy (Andhra Univ., Waltair, India). Proc. Indian Acad. Sci. A, 42, 71-6(1955) Aug.

As a part of an attempt to develop new methods of measurement of diffusion constant of metals and non-metals into minerals using radioactivity techniques, expressions are derived to relate the processes of diffusion and the emission of alpha-particles under three sets of possible experimental conditions. The first case pertains to a plate whose thickness is equal to the characteristic range of the alpha-rays of the radionuclide used. Under the second case is considered a plate thicker than the characteristic range of the alpha-rays in the plate. The third deals with cases wherein the radioactive matter used emits alpha-rays with different ranges less than the thickness of the plate. (auth)

RADIATION EFFECTS

441

DIFFUSION SCHEME OF RADICALS AROUND THE PATHS OF IONIZING PARTICLES IN LIQUIDS. John L. Magee (Univ. of Notre Dame, Ind.). J. chim. phys. 52, 528-38 (1955) July-Aug. (In French)

The paths of ionizing particles in liquids show strong local concentrations of intermediate reaction products, formed by the action of these particles and the secondary electrons which they liberate. It is assumed, in many interpretations of the effect of radiation on liquids, that the only intermediate components are the radicals. Here the attenuation of paths formed exclusively of radicals by the effects of scattering and reactions is examined. Detailed schemes are presented for the paths of electrons and protons. The competition of radical recombination reactions and their reactions with radical acceptors is examined. (tr-auth)

442

CHEMICAL EFFECTS DUE TO EXCITATION BY SECONDARY ELECTRONS PRODUCED BY IONIZING RADIATION. Joseph Weiss (Univ. of Durham, Newcastle, England). J. chim. phys. 52, 539-44(1955) July-Aug. (In French)

It is known that the energy given up by the secondary electrons produced by ionizing radiations is used in the processes of excitation and ionization, and that the secondary electrons are left with a kinetic energy less than the lowest excitation level of the molecules appearing in the system. This can be of particular importance in systems of two or more components, since in the last case, with the attenuation of electron energy, the excitation and ionization will be limited to those molecules whose excitation potential is sufficiently low. This will continue as long as the kinetic energy of the electrons is higher than the lowest excitation level of the molecules in the system. The application of these principles to the chemistry of radiations and to fluorescence induced by radiation is discussed. (tr-auth)

443

ADDITIONAL CONDUCTANCE OF HgI_2 EFFECTED BY

X RAYS. D. V. Chepur and V. A. Petrusevich. Zhur.
Tekh. Fiz. 25, 1523-9(1955) Sept. (In Russian)

Results of this investigation indicate the high sensitivity
of HgI_2 to x rays, the dependence of HgI_2 sensitivity on the
radiation spectra increasing with the hardness of the rays.
It is also demonstrated that the electrons are the carriers
of the photocurrent and that the photo-resistance of HgI_2
has a small inertia (relaxation time about 0.001 sec.).
(R.V.J.)

444

INHIBITOR BREAKDOWN IN ZINC-BROMIDE SHIELDING
WINDOWS. Daniel T. Haworth (Marquette Univ., Milwaukee,
Wisconsin). Nucleonics 13, No. 10, 66(1955) Oct.

The radiation-induced breakdown and discoloration of
ZnBr shielding windows, to which a hydroxylamine hydro-
chloride inhibitor has been added, are studied using various
inhibitor concentrations. Results show that the most
economical inhibitor concentration lies in the range 3.8 to
4.5 oz. of inhibitor to 100 gal of ZnBr. (B.J.H.)

445

RADIATION INDUCED CHANGES IN THE STRUCTURE OF
POLYISOBUTYLENE. P. Alexander, R. M. Black, and
A. Charlesby (Chester Beatty Research Inst., Institute of
Cancer Research, Royal Cancer Hosp., and Atomic Energy
Research Establishment, Harwell, Berks, England).
Proc. Roy. Soc. (London) A232, 31-48(1955). Oct. 11.

Polyisobutylene suffers random main-chain fracture
when exposed to high radiation. Identical results are
produced by electron and γ radiation and the average
energy absorbed per break amounts to 20 eV at 20°C. The
unsaturation produced is proportional to the number of
breaks. A new absorption band appears in the infra-red at
11.25 μ, which indicates that a vinyl double bond of the
type $R_1R_2C = CH_2$ has been introduced. The gases evolved
on irradiation have been analyzed. A chemical mechanism
for the degradation has been proposed. The energy per
break varies with temperature, the relationship being
somewhat similar to the inactivation behavior of ionizing
radiation on certain biological systems. The ultra violet
absorption spectrum is different for polymers which have
been irradiated in vacuum or nitrogen from those irradi-
ated in air but the number of main-chain breaks is not
affected by the surrounding gas. (auth)

Refer also to abstract 14.

RADIOACTIVITY

446

RADIOACTIVITY OF Cs^{134}. G. Bertolini, M. Bettoni, and
E. Lazzarini (Istituto di Fisica Sperimentale del Politecnico,
Milan, Italy). Nuovo cimento (10), 2, 273-89(1955) Aug.

The β decays of Cs^{134} and the γ decays of Ba^{134} have been
investigated with an intermediate image β spectrometer and
a scintillation spectrometer. From $\beta-\gamma$ coincidences, a
new β decay of 335 kev endpoint has been revealed, and the
existence of a weak β decay from the 1350 kev level of Ba
has been confirmed. From $\beta-\gamma$ and $\gamma-\gamma$ coincidences and
from internal conversion coefficients, the relative intensity
of the β decays and the multipolarity of γ transitions have
been investigated. The five excited states of Ba^{134} are
assumed to have energies of 795, 1350, 1395, 1700 and
1949 kev. Their spins and parities are 2+, 2+, 3+ or 4+,
3+ or 4+ and 4+. (auth)

447

ON THE ENERGY DISTRIBUTION AND THE EMISSION
PROBABILITY OF INTERNAL BREMSSTRAHLUNG IN Ge^{71}_{32}.
A. Bisi, L. Zappa (Istituto di Fisica Sperimentale del
Politecnico, Milan, Italy), E. Germagnoli, and E. Zimmer
(Laboratori CISE, Milan, Italy). Nuovo cimento (10), 2,
290-300(1955) Aug.

The continuous γ spectrum due to bremsstrahlung asso-
ciated with the orbital electron capture in Ge^{71} has been
investigated with a scintillation spectrometer. The inten-
sity distribution of the spectrum in the energy range be-
tween 50 kev and the upper limit of energy (E_{max} = 220 ±
3 kev) was found to agree closely with the one calculated
according to the theory developed by Morrison and Schiff.
The ratio of the total number of bremsstrahlung quanta to
the number of K captures in the interval of energy between
70 kev and the upper limit was $(2.3 \pm 0.5) \cdot 10^{-5}$, which also
is in satisfactory agreement with the theoretical value.
The half life of Ge^{71} was checked and found to be 12.5 ± 0.1
days. The type of transition is briefly discussed according
to nuclear shell model. Some results concerning the decay
of As^{77} which have been obtained during the present measure
are also reported. (auth)

448

ON THE DECAY SCHEME OF $_{83}Bi^{214}$(RaC). R. A. Ricci
and G. Trivero (Istituto di Fisica sperimentale del
Politecnico, Torin, Italy). Nuovo cimento (10) 2, 745-
59(1955) Oct. (In Italian) (cf. NSA 9-2976 and 9-4629)

Experiments have been continued concerning the spectrum
of Bi^{214}, analyzing the absorption of the β radiation and the
determination of $\beta-\gamma$ coincidences with complete separation
of the γ rays from Po^{214}. The results are consistent with
those of Wapstra and Latishev referring to the maximum
energy of the β transition in the fundamental state (3.17 Mev)
(relative intensity 13%), and confirm the presence of a
transition energy of 2.56 Mev at the first excited state of
Po^{214}, already reported by us, of relative intensity of about
6%. The spectrum analysis reveals the presence of other β
transitions of energy 1.720 Mev (relative intensity 7%),
1.44 Mev (30%), and 1.03 Mev (22%). Transitions of energy
less than 1 Mev certainly exist and their relative intensity,
following our results, should be ≈20%. From this a β-decay
scheme may be deduced for Bi^{214} which is in fairly good
accord with the scheme of γ levels of Po^{214} recently
proposed by Demichelis and Maivano. (auth)

449

DECAY OF Cs^{134}. H. H. Forster and J. S. Wiggins (Univ.
of Southern California, Los Angeles). Nuovo cimento (10)
2, 854-6(1955) Oct.

450

DISINTEGRATION SCHEME OF Rb^{83}. M. L. Perlman and
Joan P. Welker (Brookhaven National Lab., Upton, N. Y.).
Phys. Rev. 100, 81-2(1955) Oct. 1.

The decay of Rb^{83} has been determined to proceed by
electron capture to an excited state of Kr^{83} which is 0.566
Mev above the ground state. This excited state is de-
populated exclusively by emission of a 0.525-Mev gamma
ray (M1) to the 0.041-Mev state, Kr^{83m}. Little or no
electron capture direct to the 0.041-Mev level or to lower
levels occurs. The spin-parity designation of the 0.566-
Mev state is p$\frac{3}{2}$, and that of the Rb^{83} ground state is
f$\frac{5}{2}$. (auth)

451

GAMMA-RAY BRANCHING IN Sr^{89}. W. S. Lyon and R. R.

Rickard (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 112(1955) Oct. 1.

The decay of strontium-89 has been found to proceed through Y^{89m} to the extent of 0.02%. (auth)

452

HALF-LIFE OF TRITIUM. W. M. Jones (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 100, 124-5(1955) Oct. 1.

A value of 12.262 ± 0.004 years has been found for the tritium half life by measurement of the He^3 growth in two samples. (auth)

453

THEORY OF ATOMIC PERTURBATION IN ALPHA DECAY. H. M. Schwartz (Univ. of Arkansas, Fayetteville). Phys. Rev. 100, 135-37(1955). Oct. 1.

A method for calculating the probabilities of internal atomic excitation in alpha decay is outlined and compared with earlier work by other authors. (auth)

454

COMPLEX ALPHA AND GAMMA SPECTRA OF $Cf^{250,252}$. Frank Asaro, Frank S. Stephens, Jr., B. G. Harvey, and I. Perlman (Univ. of California, Berkeley). Phys. Rev. 100, 137-52(1955). Oct. 1.

The alpha and gamma spectra of Cf^{250} and Cf^{252} have been investigated with an α-particle spectrograph and an α-particle γ-ray coincidence counter. Alpha groups of 6.112 (84.5%) and 6.069 Mev (15.5%) belonging to Cf^{252} were found, as were groups of 6.024 (83%) and 5.980 Mev (17%), belonging to Cf^{250}. L x rays and γ rays of 42 (0.014%) and 100 kev (0.01₃%) were assigned to Cf^{252}. Other γ rays were assigned to odd-mass californium isotopes. The results are evaluated with respect to the current theory and systematics of complex α spectra and excited states of even-even nuclei. (auth)

455

DOUBLE K CAPTURE AND SINGLE K CAPTURE WITH POSITRON EMISSION. Rolf G. Winter (Pennsylvania State Univ., University Park). Phys. Rev. 100, 142-4(1955). Oct. 1.

Transition probabilities are estimated for double K capture and for single capture with single positron emission. With real neutrino emission, the mean lives for both processes should be greater than 10^{24} years. Without real neutrino emission, as with Majorana neutrinos, the mean life for K-capture in conjunction with positron emission is about 10^{15} years in the allowed approximation. Double K-capture, however, is then at least a third-order process because an additional step is necessary to remove the energy, with the result that the mean life exceeds 10^{18} years. (auth)

456

RADIOACTIVITY OF THE CERIUM-137 ISOMERS. A. R. Brosi and B. H. Ketelle (Oak Ridge National Lab., Tenn.). Phys. Rev. 100, 169-70(1955) Oct. 1.

A cerium isotope with an 8.7-hr half life has been assigned to Ce^{137} and shown to decay be electron capture with about 3% of the captures to a 445-kev level in La^{137}. The 34.5-hr decay period previously characterized as electron capture of Ce^{137} is an isomeric transition from a 255-kev level in Ce^{137}. Spin assignments consistent with the experimental data indicate that the transition between ground states of La^{137} and Ba^{137} should be allowed. However, the

K or L electron capture half life of La^{137} was found to be greater than 10^8 years. (auth)

457

RADIOACTIVE DECAY OF RUTHENIUM-97. J. M. Cork, M. K. Brice, L. C. Schmid, and R. G. Helmer (Univ. of Michigan, Ann Arbor). Phys. Rev. 100, 188-90(1955) Oct. 1.

Ruthenium enriched in mass 96 was irradiated for short and long periods in the pile, and the radioactivity of Ru^{97}, produced by neutron capture, was studied by magnetic and scintillation spectrometers. Several γ rays not previously reported were found to exist. The observed γ rays in Tc^{97}, following K capture in Ru^{97}, have energies of 109.1, 216.1, 325.1, and 570 kev. A long-lived metastable state in Tc^{97} decays by the emission of γ rays whose conversion electrons indicate γ energies of 90.2 and 99.2 kev. The multi-polarities of most of the transitions are determined and a satisfactory nuclear level scheme is proposed. (auth)

458

THE HALF-LIFE OF Cs^{137}. F. Brown, G. R. Hall, and A. J. Walter (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 1, 241-7(1955) Oct.

The β-decay half-life of Cs^{137} has been obtained from a specific activity measurement. The disintegration rate was measured in a 4π-type proportional counter. The number of atoms of Cs^{137} was measured by mass spectrometry, using the isotopic dilution method. The result is $30.0^{+0.3}_{-0.4}$ years, (auth)

459

THE DECAY CHAIN $Pu^{245}-Am^{245}-Cm^{245}$. C. I. Browne, D. C. Hoffman, W. T. Crane, J. P. Balagna, G. H. Higgins, J. W. Barnes, R. W. Hoff, H. L. Smith, J. P. Mize, and M. E. Bunker (Los Alamos Scientific Lab., N. Mex.). J. Inorg. and Nuclear Chem. 1, 254-61(1955) Oct.

Pu^{245} and Am^{245}, have been produced by neutron irradiation methods. The study of the radiations of these nuclides is described and a preliminary decay scheme for Am^{245} is presented. (auth)

460

PRODUCTION OF Pu^{245} AND Am^{245} BY NEUTRON IRRADIATION OF Pu^{244}. P. R. Fields, M. H. Studier, A. M. Friedman, H. Diamond, R. Sjoblom, and P. A. Sellers (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 1, 262-6(1955) Oct.

Pu^{245} and Am^{245} were prepared by neutron irradiation of Pu^{244}. The β-decay half-lives of Pu^{245} and Am^{245} were found to be 10.1 ± 0.5 hours and 119 ± 1 minutes, respectively. The β-decay energy of Am^{245} was found to be 0.86 Mev by absorption methods, and γ rays of 260, 121, and 70 kev were resolved with a sodium iodide crystal spectrometer. The thermal neutron capture cross-section of Pu^{244} was determined to be 1.4 barns. (auth)

461

EXACT ALPHA-PARTICLE ENERGIES FOR THE ISOTOPES Em^{211}, Em^{210}, Em^{209}, Em^{208}, AND Fr^{212}. F. F. Momyer, Jr., F. Asaro, and E. K. Hyde (Univ. of California, Berkeley). J. Inorg. and Nuclear Chem. 1, 267-73(1955) Oct.

The α-particle energies of Rn^{208}, Rn^{209}, Rn^{210}, Rn^{211}, and Fr^{212} have been measured using a magnetic spectrograph. The glow-discharge procedure was used for the preparation of the isotope samples. (C.W.H.)

462

THE INFLUENCE OF THE 126-NEUTRON SHELL ON THE ALPHA-DECAY PROPERTIES OF THE ISOTOPES OF EMANATION, FRANCIUM, AND RADIUM. F. F. Momyer, Jr. and E. K. Hyde (Univ. of California, Berkeley). J. Inorg. and Nuclear Chem. 1, 274-95(1955) Oct.

Nuclear data, including half-life, α-particle and γ-ray energies, and α branching, are presented for Rn^{206}, Rn^{207}, Rn^{208}, Rn^{209}, Rn^{210}, Rn^{211}, Ra^{213} and Fr^{212}. The methods of chemical purification, energy measurements, and cyclotron formation are discussed. (C.W.H.)

463

THE HALF-LIFE OF EMANATION-220. H. Schmied, R. W. Fink, and B. L. Robinson (Univ. of Arkansas, Fayetteville). J. Inorg. and Nuclear Chem. 1, 342-4(1955) Oct.

The half life of Rn^{220} as measured with an α-proportional counter is 51.5 ± 1 sec. (C.W.H.)

464

RADIOACTIVE DISINTEGRATION OF ^{232}Th. S. W. Peat and M. A. S. Ross (Univ. of Edinburgh, England). Proc. Phys. Soc. (London) A68, 923-5(1955) Oct. 1.

An improved nuclear emulsion method was used to resolve discrepancies reported for the excitation energy of the first excited state of Ra^{228} from α decay of Th^{232}. A study of the three-dimensional ranges of 142 conversion electrons associated with the α particles gave a value of 59 ± 1 kev for this state. (L.M.T.)

465

DESIGN OF AN INEXPENSIVE HIGH-INTENSITY GAMMA SOURCE. Milton Burton, (Univ. of Notre Dame, Ind.), J. A. Ghormley and C. J. Hochanadel (Oak Ridge National Lab., Tenn.). Nucleonics 13, No. 10, 74-7(1955) Oct.

The design, advantages, and construction of an inexpensive high-intensity Co^{60} source are described. (B.J.H.)

466

GAMMA RADIATION AND DECAY SCHEME OF La^{140}. L. V. Arkhangel'skii, B. S. Dzhelepov, N. N. Zhukovskii, V. P. Prikhodtseva and Yu. V. Khol'nov. (Khlopin Radium Inst.) Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 251-70 (1955) May—June. (In Russian)

A new scheme of La^{140} is demonstrated after γ spectra measurements, comparative study of the following isobars with mass number 140 is made: Xe^{140}, Cs^{140}, Ba^{140}, Pb^{140}, and Nd^{140}. 55 references. (R.V.J.)

467

GAMMA RADIATION FROM Au^{198}. B. S. Dzhelepov, N. N. Zhukovskii, V. P. Prikhodtseva and Yu. V. Khol'nov. (Khlopin Radium Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 271-6(1955) May—June. (In Russian)

Investigation concerning γ radiation of Au^{198} based on two new γ lines of 676 and 1089 Ke and associated $\beta-\gamma$ and $\gamma-\gamma$ coincidences. Systematic and detailed description of the Au^{198} decay scheme is given. 31 references. (R.V.J.)

468

GAMMA SPECTRA OF Ir^{192}. M. P. Glazunov, B. S. Dzhelepov and Yu. V. Khol'nov. (Radium Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 294-5(1955) May—June. (In Russian)

The hard and soft γ lines of Ir^{192} were studied, and the table of results is given. (R.V.J.)

469

GAMMA RADIATION FROM $Eu^{152,154}$. B. S. Dzhelepov, N. N. Zhukovskii and V. G. Nedovesov. (Khlopin Radium Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 296-9 (1955). May—June. (In Russian)

Gamma spectral lines obtained with a spectrometer with improved focusing are discussed. The conversion electrons were measured with cellophane targets of 17 and 50μ. (R.V.J.)

470

INVESTIGATION OF ANGULAR CORRELATION OF INTERNAL CONVERSION ELECTRONS OF Br^{80}_{35}. B. A. Shakhbazyan and L. I. Rusinov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 308-15(1955) May—June. (In Russian)

Measurements were made after placing the Br^{80} source in a glass chamber filled with a mixture of 90% He and 10% ethyl alcohol vapors and arranging the coincidence equipment for counting at angles of 90, 75, 60, 45, and 30°. Results are given for the angular correlation function $W(\theta)$ at these angles for four different experiments, and are accurate to within ±6%. The experimental results are compared with theoretical calculations. (R.V.J.)

471

COINCIDENCE STUDY OF Tb^{160} RADIATION. I. P. Stepanenko and L. Ya. Shavtvalov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 318-23(1955) May—June. (In Russian).

A circuit diagram of the linear amplifier and differential analyzer used with the scintillation spectrometer is given. The results from the authors' measurements agree with the Tb^{160} decay scheme proposed by Burson et al. (Phys. Rev. 94, 103(1954). (R.V.J.)

472

STUDY OF NUCLEAR ISOMERISM OF Zn^{69}, Se^{79}, Se^{81}, Nb^{95}, Rh^{103}, AND Ba^{137}. G. M. Drabkin, V. I. Orlov and L. I. Rusinov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 324-37(1955) May—June. (In Russian)

Multiplicity of γ radiation of Zn^{69}, Se^{79}, Se^{81}, Nb^{95}, Rh^{103} and Ba^{137} and the absolute and relative coefficients of internal conversion electrons were investigated. An improved decay scheme and table of isomeric transitions are given for these nuclei. (R.V.J.)

473

DETECTION OF SHORT-PERIOD ISOMERS. P. A. Yampol'skii, O. I. Leipunskii, M. Ya. Gen and A. M. Tikhomirov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 338-42(1955) May—June. (In Russian)

Isomers of short-period activity from Bi and Pb targets exposed to fast neutron radiation were investigated using improved detection apparatus. The short-period isomer of Pb^{207} was further established and an isomeric transition is believed to exist from Bi^{208}. (R.V.J.)

474

LIFETIME OF EXCITED STATES OF CERTAIN NUCLEI. E. E. Berlovich. (Leningrad Physico-Technical Inst.) Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 343-51(1955) May—June. (In Russian)

Detailed decay schemes for Ta^{181}, Sr^{86}, Tl^{203}, Fe^{59} and Co^{59} based on the work of R. Bell et al. (Can. J. Phys. 30, 35(1955)) are presented, and additional information on measurements of half-life periods of excited states of nuclei in 10^{-10} to 10^{-8} sec interval are included. (R.V.J.)

475

ON THEORY OF DOUBLE β-DECAY. L. A. Maksimov and Ya. A. Smorodinskiĭ. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 365-76(1955) May—June. (In Russian)

Only transitions from one basic state to another are considered. The initial Ca^{48} to Ti^{48} transition is discussed. (R.V.J.)

476

EFFECT OF PRESSURE ON RADIOACTIVE HALF LIVES. Evry Schatzman. Compt. rend. 241, 853-4(1955) Oct. 3. (In French)

Under the effect of pressure, the barrier potential undergoes a modification which leads to the increase of the radioactive half life. The increase is not appreciable for natural radioelements except at the very high densities ($\rho > 10^{10}$) occurring in certain stars. (auth)

477

ON THE INTERNAL AND EXTERNAL BREMMSSTRAHLUNG OF S^{35}. Helene Langevin-Joliot. Compt. rend. 241, 872-5(1955) Oct. 3. (In French)

The internal bremsstrahlung spectrum of S^{35}, obtained with a scintillation spectrometer in an appropriate apparatus, disagrees, more in form than in intensity, with theory. The number of photons reaches 400% of the theoretical value above 90 kev. The external bremsstrahlung spectra, emitted during complete absorption of the S^{35} electrons in carbon and aluminum, are in good agreement with theory. (tr-auth)

478

ANGULAR CORRELATION OF GAMMA RAYS FROM Fe^{*56}. Mitsuo Sakai (Ohio State Univ., Columbus). J. Phys. Soc. Japan 10, 729-35(1955) Sept.

The γ rays emitted in the decay of Co^{56} were studied by $\gamma-\gamma$ angular correlation measurements. The results of these experiments permitted the discussion of the energy levels of the daughter nucleus, Fe^{56}. The $\gamma-\gamma$ coincidence experiment showed the presence of a 2.03-Mev γ, decaying to the second excited level. One part of the decay scheme was confirmed by positron-γ coincidence experiment. The first and the second excited levels were assigned to be 2 + and 4 + respectively from the special consideration on the angular correlation data. The spins of the other levels are discussed. (auth)

Refer also to abstracts 328, 336, 339, 358, and 366.

RARE EARTHS AND RARE-EARTH COMPOUNDS

479

COULOMB EXCITATION OF RARE-EARTH NUCLEI WITH ALPHA PARTICLES. N. P. Heydenburg and G. M. Temmer (Carnegie Institution of Washington, D. C.). Phys. Rev. 100, 150-66(1955) Oct. 1.

Using a doubly charged He beam at 6 Mev, most low-lying (rotational) states in the nuclei between Z = 60 and Z = 73 have been excited. Assignments were made with isotopically enriched targets where available. On the whole the predictions of the "strong coupling" approximation of the unified model are strikingly borne out. All 2^+ first-excited states of even-even nuclei lying below ~600 kev were observed, some of which were previously unknown. Two excited states were found in most odd-A nuclei as revealed by direct and/ or cascade radiation to the ground state as well as coinci-

dence measurements. The positions of the first two rotational levels agree with the simple interval rule in all established cases within the experimental accuracy. The majority of these states are not found in beta-ray spectroscopy. The reduced electric-quadrupole transition probabilities for all these transitions were measured and found to be some 50 to 100 times greater than those expected for an independent particle. Good agreement was found with some values of these quantities available from direct lifetime observations, giving us confidence in the correctness of both the theoretical expression for the total excitation cross section, and the experimental approach for its determination. A systematic decrease in these transition probabilities is evident in even-even nuclei upon approaching the closed-neutron shell at N = 82; a corresponding increase in the energy of the 2^+ levels reflects the common origin of both phenomena, namely the decrease of the intrinsic deformation of the nuclei. However, the absolute magnitude derived for this deformation depends upon which manifestation is used. Some evidence for a difference is splitting constants $\hbar^2/2I$ between even-even, even-odd, and odd-even nuclei is found. Within the rather large uncertainties the transition probabilities do not seem to show a corresponding variation. (auth)

480

HYPERFINE STRUCTURE OF PRASEODYMIUM. J. M. Baker and B. Bleaney (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A68, 936-7(1955) Oct. 1.

Paramagnetic resonance measurements were made on Pr ethyl sulfate (with Y as diluent) and rather narrower lines obtained, with the asymmetrical shape characteristic of resonance from a doublet without Kramer's degeneracy. Taking the value of $\langle r^{-3} \rangle$ as $37 \pm 2A^{-3}$, the nuclear magnetic moment is estimated as $3.9_2 \pm 0.2$ n.m. (L.M.T.)

481

NUCLEAR MOMENTS OF THE LANTHANONS FROM PARAMAGNETIC RESONANCE. B. Bleaney (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A68, 937-9(1955) Oct. 1.

The formula $\langle r^{-3} \rangle = 0.89 (Z - 47)^{3/2} A^{-3}$ is suggested for the calculation of nuclear moments from hfs in paramagnetic resonance spectra, after which the moments deduced for the lanthanons by use of the formula are presented. (L.M.T.)

SHIELDING

482

HIGH UNIT WEIGHT CONCRETES FOR RADIATION SHIELDING. David L. Narver, Jr. Los Angeles and Washington, D. C., Holmes and Narver, Inc., 1955? 24p.

Considerations involved in the design of mixes for structural concrete of high unit weight, utilizing limonite and magnetite ores as fine aggregate and graded steel scrap as coarse aggregate are discussed. Criteria are presented for proportioning a concrete mix to have a specific unit weight as well as a specific compressive strength. Employing various combinations of conventional coarse aggregate and steel aggregate and either conventional, limonite, or magnetite fine aggregate, it is stated that concrete can be produced with a density range of from 140 pounds per cubic foot to 330 pounds per cubic foot. A compressive strength of 3000 psi is reported to be ob-

tainable without difficulty. Applications as radiation shielding are discussed briefly. (auth)

SPECTROSCOPY

483   AECU-3089
Los Alamos Scientific Lab., N. Mex.
THE LAPLACE TRANSFORM METHOD OF OBTAINING X-RAY SPECTRAL ENERGY DISTRIBUTIONS. C. Robert Emigh. Nov. 10, 1954. 29p. Contract [W-7405-eng-36].

This method essentially consists of analyzing x-ray filtration data in terms of Laplace transforms and obtaining the spectral energy distribution in terms of a sum of the corresponding inverse Laplace transforms. Some of the functions which are especially suited for this application are given and a graphical method of analyzing filtration data in terms of these functions is described. Examples of the practical application of this method to several low-energy x-ray machines are included with a discussion of the advantages, disadvantages, and probable uncertainties which are involved. (auth)

484   OSR-TN-55-184
Michigan. Univ., Ann Arbor. Engineering Research Inst.
RADIATION FROM A STRONG SHOCK FRONT IN KRYPTON. E. B. Turner. July 1955. 11p. Project No. R-357-40-6. Contract AF 18(600)-983. (ERI-2189-1-T)

Petschek observed that a very strong shock front in argon is usually seen as a bright luminous line. We have shown from wave-speed photographs in krypton with a revolving drum camera at an angle to the shock tube, that the luminosity is homogeneous across the front and not a wall effect. Another series of wave-speed photographs were made with a wedge interference filter placed in front of a horizontal slit on the shock tube. These showed mainly line radiation, but the lines were not those of krypton. A spectrum was obtained by rotating the film drum at such a speed that the image of the shock front was stationary on the film. The Swan bands of carbon, which arise from organic vapors, as well as the lines of Ca and Na were observed. The sharp luminous front is apparently due to inelastic collisions between these vapors and krypton atoms in the zone where translational equilibrium is not yet established. (auth)

485   AEC-tr-2286
RESEARCH ON A NEW METHOD OF ANALYZING DEBYE-SHERRER DIAGRAMS. G. A. Homes and J. Gouzou. Translated by K. S. Bevis from Rev. mét. 51, 749-57(1954). 20p.

A new method is proposed for analyzing x-ray-diffraction diagrams to identify metallurgical compounds. The method is based on the successive determination of a certain number of plane sections in the reciprocal lattice. In principle, the method is applicable to the analysis of all Debye-Sherrer diagrams, and analysis is made entirely in one operation. The application of the method to hexagonal and orthorhombic lattices is illustrated. (M.P.G.)

486
A FURNACE FOR OBTAINING OPTICAL SPECTRA OF RADIOACTIVE ELEMENTS. L. F. H. Bovey (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 32, 376-8(1955) Oct.

The construction and operation of a King-type furnace for

exciting spectra of radioactive or toxic materials are described. Both emission and absorption spectra of uranium and plutonium have been observed within the range 2400 to 7000 A, in the second order of a 3 m grating spectrograph. (auth)

THEORETICAL PHYSICS

487   AECU-3094
Los Alamos Scientific Lab., N. Mex.
NOTE ON AN APPROXIMATION METHOD OF BRUECKNER, LEVINSON, AND MAHMOUD. Walter Goad. [1955]. 7p. Contract [W-7405-eng-36].

Two calculations are reported which help to clarify the nature of the approximation made in the method of Brueckner et al. for the ground state of many-Fermion systems. The first is a formal calculation of their result for the energy in terms of two-body forward scattering amplitudes from elementary perturbation theory. The second calculation is an application of the method to the ground state of liquid He^3. (M.P.G.)

488   NBS-3328
National Bureau of Standards, Washington, D. C.
CONTRIBUTION TO THE DEVELOPMENT OF QUANTUM STATISTICS. Irwin Oppenheim and John Ross. Oct. 10, 1955. 17p. NBS Project 0302-10-2641.

The Bloch equation for the Wigner distribution function is introduced and power series solutions in Planck's constant and the potential of the system are obtained. Transformation functions for the density matrix and the Wigner function are discussed. The problem of quantum statistics (Bose-Einstein or Fermi-Dirac) is investigated. (auth)

489   ORNL-1972
Oak Ridge National Lab., Tenn.
INTERNAL CONVERSION ANGULAR CORRELATIONS. E. V. Ivash and M. E. Rose. Oct. 20, 1955. 14p. Contract W-7405-eng-26.

The problem of angular correlations involving conversion electrons has been extended to the cases of the 2^L magnetic pole$-2^{L'}$ electric pole mixture for s, $p_{1/2}$, and $p_{3/2}$ electrons with L = L' + 1, and the 2^L electric pole$-2^{L'}$ magnetic pole mixture for $p_{1/2}$ and $p_{3/2}$ electrons and L = L' + 1. Analytic results are presented. (B.J.H.)

490   UCRL-3098
California. Univ., Berkeley. Radiation Lab.
THE THEORY AND INTERPRETATION OF POLARIZATION PHENOMENA IN NUCLEAR SCATTERING (thesis). Henry Pierce Stapp. Aug. 1955. 128p. Contract W-7405-eng-48.

A theoretical investigation of polarization phenomena in nuclear scattering is made. The expressions needed for a phase-shift analysis of polarization, triple scattering, and correlation experiments in nucleon-nucleon scattering are derived, and the results of a phase-shift analysis are given for proton-proton (p-p) scattering at 310 Mev. The theory of the correlation experiments is then developed, and an explicit expression for the scattering matrix at 90° as a function of these correlation experiments together with the triple scattering experiments is obtained. The symmetry effects in p-p scattering and the formalism relating the n-p to p-p experiments is developed, and the problem of separating the nuclear phase shifts from the coulomb parts is discussed. A covariant treatment of polarization

phenomena in double and triple scattering of Dirac parti-
cles from spin-zero targets and from Dirac particles is
developed and the relativistic triple scattering and correla-
tion expressions are obtained. The nonrelativistic scatter-
ing matrix of spin-one particles by spin-zero targets is
developed. The available data on deuteron polarization are
analyzed in terms of first and second Born approximations.
The effect of the D-state of the deuteron upon the polariza-
tion phenomena is also considered. (auth)

491   AEC-tr-2292
KINETIC THEORY OF A SYSTEM OF INTERACTING
PARTICLES. A. E. Glauberman. Translated from Zhur.
Eksptl'. i Teoret. Fiz. 25, 560-70(1953). 12p. Available
from Associated Technical Services (Trans. 01G7R), East
Orange, N. J.

Equations are derived for the kinetic distribution func-
tions for a system consisting of interacting particles of
different kinds in the general case of the presence of
external forces which depend in an arbitrary way on the
coordinates and the velocities of the particles. Under the
condition that the acting forces are conservative, equations
for the equilibrium distribution function are derived. Using
the method of N. N. Bogolyubov, the derivation of the kinetic
equation for a system of interacting charged particles (ions)
of different kinds is examined in detail. (auth)

492
ON A NEW METHOD OF OBTAINING THE LEVELS OF
NUCLEAR ROTATION. Claude Marty. Compt. rend. 241,
855-7(1955) Oct. 3. (In French)

A simple model of a core coupled to N nucleons is con-
sidered, and the general properties of the corresponding
Hamiltonian are studied, without assuming that the nu-
cleons have well defined orbits. (auth)

493
MANY-BODY PROBLEM FOR STRONGLY INTERACTING
PARTICLES. II. LINKED CLUSTER EXPANSION. K. A.
Brueckner (Indiana Univ., Bloomington). Phys. Rev.
100, 36-45(1955) Oct. 1.

An approximation method developed previously to deal
with many particles in strong interaction is examined in
further detail. It is shown that the series giving the inter-
action energy is a development in a sequence of linked or
irreducible cluster terms each of which gives a contribu-
tion to the energy proportional to the total number of
particles. Consequently the convergence of the expansion
is independent of the total number of particles. The origin
of this simple feature is illustrated by showing that a
similar situation exists in the expansion of standard
perturbation theory. The numerical convergence of the
expansion is quantitatively discussed for the nuclear prob-
lem where it is shown that the correction arising from the
first cluster term involving three particles is less than the
leading term by a factor of about 10^{-4}. The smallness of the
correction is largely a result of the action of the exclusion
principle. (auth)

494
MOMENTUM DEPENDENCE OF PHASE SHIFTS. Charles
J. Goebel, Robert Karplus, and Malvin A. Ruderman (Univ.
of California, Berkeley). Phys. Rev. 100, 240-1(1955)
Oct. 1.

A lower limit is found for the momentum derivative of the
scattering phase shifts of a relativistic neutral two-particle
system when the interaction is of finite range. (auth)

495
A THEORY OF NEW PARTICLES. Ryoyu Utiyama (In-
stitute for Advanced Study, Princeton, N. J.). Phys. Rev.
100, 248-54(1955) Oct. 1.

A tentative scheme is developed to formulate the be-
havior of the new unstable particles. This scheme is a
straightforward generalization of the usual charge-inde-
pendent meson theory. The selection rules for isotopic
spin are identical with those suggested by Gell-Mann.
Owing to the particular form of the interaction assumed in
this scheme, we can derive a new selection rule which
seems to be of some use in interpreting the metastability
of the new particles. (auth)

496
EXTENDED ISOTOPIC SPIN INVARIANCE AND MESON-
NUCLEON COUPLING. Sidney A. Bludman (Univ. of Cali-
fornia, Berkeley). Phys. Rev. 100, 372-5(1955) Oct. 1.

The identities derived from a Lagrangian density that is
invariant under transformations that depend on arbitrary
functions are used to develop the restrictions on allowed
forms of coupling that follow from assuming extended iso-
topic spin invariance. A proof is given that invariance under
local isotopic spin rotations is not possible for pions and
nucleons alone. The relations between the transformation
law and the invariant Lagrangian are developed if (a) the
pion-nucleon system is allowed to admit a more general ex-
tended isotopic spin group, or' (b) additional fields are ad-
mitted in order to maintain the local isotopic spin rotational
invariance. In either case, definite restrictions on the per-
missible transformation properties for the field quantities
are obtained if pion-nucleon isotopic spin conservation is to
be maintained. (auth)

497
STRUCTURE OF GREEN'S FUNCTIONS IN QUANTUM
FIELD THEORY. Yoichiro Nambu (Institute for Nuclear
Studies, Chicago). Phys. Rev. 100, 394-411(1955) Oct. 1.

The Green's functions are vacuum expectation values of
time ordered products of field operators in the Heisenberg
representation. They give us vital information about the
nature of the interacting particles and quanta represented
by these field operators. It is shown that the Fourier
transforms of the Green's functions (for up to four oper-
ators) are expressible as parametric integrals involving
invariant energy denominators and real, scalar weight
functions which are termed the spectral functions. Rela-
tivity, causality, and some other fundamental assumptions
of field theory are required to derive the result. The
spectral functions have a simple physical interpretation,
and completely specify the structure of the Green's func-
tions of different order can be translated into the corre-
sponding relations between the spectral functions. Re-
normalization can be carried out explicitly, bringing the
equations for the spectral functions into a manifestly re-
normalized form. The causality condition also serves as a
means of obtaining renormalized quantities without recourse
to the usual subtraction procedure. The observed masses
and coupling constants occur in the equations for the
spectral functions as external parameters fixing the
boundary condition. No unobservable bare masses and
couplings, nor the (infinite) renormalization constants ever
appear in the equations. These quantities, however, are
shown to be expressible in terms of the spectral functions.
The Green's functions involving more than four field
operators are not considered in this paper. (auth)

498

NUCLEAR HARTREE-FOCK CALCULATIONS. M. Rotenberg (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 100, 439-40(1955) Oct. 1.

Two self-consistent calculations for 184 nucleons (N = Z = 92) have been carried out. The assumed 2-body internucleon interactions were Gaussian and Yukawa, plus exchange. The Hartree-Fock equations were solved by assuming square-well wave functions and using an iterating procedure. It was observed that the rms radius of both the self-consistent collective potential and the particle density are within a few percent of each other. (M.P.G.)

Refer also to abstract 247.

URANIUM AND URANIUM COMPOUNDS

499   AEC-tr-2296

THE PROBLEM OF THE ANGULAR DISTRIBUTION OF FISSION FRAGMENTS OF URANIUM AT HIGH ENERGY EXCITATIONS. O. V. Lozhkin, N. A. Perfilov, and V. P. Shamov. Translated by V. N. Rimsky-Korsakoff from Doklady Akad. Nauk S.S.S.R. 103, 407(1955). 3p.

The angular distribution of fission fragments of uranium was studied by using thick-layered photographic plates. Nuclear fine-grained emulsions of the type π-9 were saturated in a uranium salt solution and bombarded with 660-Mev protons. In all the observed cases of fission of uranium nuclei the direction of scattering of fragments with respect to the direction of the falling proton and the angle between the fragments were measured (the initial excitation energy of fission nuclei was measured by the angle between the fragments). All the fissions were divided into three groups according to the energy of excitation of the fission nuclei: 60, 150, and 320 Mev. The angular distribution of the fragments of uranium fission as a function of the initial energy of excitation is given. In the case of all the observed fissions the angular distribution can be approximately described by the function $I(\phi) = a + b \sin^4 \varphi$, where φ is the projected angle between the direction of the divergence of the fragments and the direction of the falling proton. (auth)

500

THE YIELD OF Cs^{137} IN THE PILE NEUTRON FISSION OF NATURAL URANIUM. F. Brown (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 1, 248-52(1955) Oct.

The ratio of Cs^{137}/Ba^{140} yields from the pile neutron fission of natural U is 0.985 $^{+0.03}_{-0.02}$. (auth)

501

A CUBIC FORM OF URANIUM TRIOXIDE. E. Wait (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inorg. and Nuclear Chem. 1, 309-12(1955) Oct.

The crystal structure of a uranium oxide phase of composition $UO_{2.82}$ has been determined by x-ray-powder-diffraction techniques using a Guinier-type focusing camera. The unit cell is cubic with a = 4.138 ± 0.005 kX. A uranium atom is located at (000) and oxygens at ($\frac{1}{2}$00), (0$\frac{1}{2}$0), and (00$\frac{1}{2}$) with some anion vacancies. The compound is isostructural with ReO_3. The U—O bond length is 2.073 A. (auth)